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SOME METHODS OF HANDLING MINUTE HYMENOPTEROUS PARASITES[1]

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A year or so ago the writer had some experience in rearing and shipping the hymenopterous egg parasites, *Trichogramma minutum* (*pretiosa*) Riley and *Telenomus* sp. (probably *heliothidis* Ashmead). An account of this work has not been published, and the suggestion[2] has been made that the writer prepare a paper on his methods of dealing with these small insects. Though *Telenomus* is more difficult to rear than *Trichogramma*, the methods given below which were devised for the work with the latter species were found to be suitable for the former also.

At the beginning of his work the writer had the advantage of some suggestions which Mr. W. F. Fiske made to Dr. L. P. de Bussy, who transmitted them in the following words:

"He (Mr. Fiske) handles the insects in very narrow tubes (2–3 mm. in width and ½–1 inch long); in this way it is very easy to study them with a lens, to see the antennæ and to know the sex.

"*Trichogramma* breeds parthenogenetically for long generations, if necessary. Mr. Fiske thinks it parasitizes any soft-shelled eggs, but probably only when the larva inside has not yet developed too much. Infertile and dead eggs (after several months of cold storage) will be infested too, and perhaps also ovarial eggs, although this has not been studied.

"An egg will not give any *Trichogramma*, when it is very often infested by one or more females. The best way is to give 25 to 50 host eggs to one female *Trichogramma*. Once, as many as 163 *Trichogramma* have been bred from two females.

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[1] Published by permission of the Chief of the Bureau of Entomology.

[2] This suggestion was made by Mr. Geo. N. Wolcott, assistant entomologist of the Board of Commissioners of Agriculture in Porto Rico, who has done much work in rearing and shipping *Trichogramma* and other parasites.

"Therefore a very large quantity of host eggs is a principal question. Mr. Fiske had infested eggs in cold storage (28–30° F.) for about ten months, after which time the adults emerged normally. It is necessary to put the infested eggs in the cold temperature at the moment when they are beginning to turn black."

The easiest and almost the only way of collecting very small egg parasites is to collect eggs parasitized by them, and to rear the parasites from the eggs. The collected eggs should be separated as well as possible from the leaves or corn silk (in the case of *Heliothis* eggs) on which they were deposited. They should then be put in glass tubes about 8 mm. wide by 24 mm. in length, about ten or fifteen eggs to a tube. A piece of fine cotton batting is very good for use as a stopper. The eggs which are not parasitized will usually hatch before the parasites emerge from the other eggs. The larvæ from the unparasitized eggs should be removed from the tube.

The parasites may be expected to emerge within a short time after the eggs turn black. Sometimes several adults of *Trichogramma* emerge from one egg, so that quite a number of parasites may be found in the tube. A very weak solution of granulated sugar and water should be made and this should be given to the parasites. A good way to feed these minute insects is to moisten the pointed end of an insect pin with the sugar solution, and to insert it into the tube, around the cotton stopper but without removing the stopper. Some of the sugar solution should be made to adhere to the side of the tube, and then the end of the pin should be withdrawn. Only a small amount of the sweet solution is necessary for the parasites. The amount should be so little, in fact, that it cannot be observed very well except with the aid of a pocket lens. If much liquid is given to the parasites they will usually be caught in it and will be unable to free themselves. Naturally, the liquid should not be so thick as to be sticky. A sugar solution which is merely sweetened water is best.

Copulation will occur soon after both males and females have emerged from the eggs in the tube. The experience of the writer indicates, however, that it is best to leave the females with the males for about twenty-four hours before giving them host eggs for oviposition. If a female is given host eggs within a few hours after emergence it seems that there is some possibility that she may escape fertilization.

When it is desired to have the parasites oviposit, they may be introduced into a tube (size 8 mm. by 24 mm.) in which a number of fresh host eggs, or host eggs which have been kept in cold storage, and a minute particle of the sugar solution have been placed. (The writer did not use the very small tubes recommended by Mr. Fiske because he could not obtain them readily.) The manner of transferring the

insects from one tube to another will be described below. In placing the parasites with fresh eggs the males may be left out of consideration. In a tube where the females are ovipositing the males walk about aimlessly and do not disturb the females. The important thing is to get some females in the tube with the fresh eggs. The females of *Trichogramma* may easily be distinguished by the antennæ, though the living individuals usually move so rapidly that it is difficult to determine the sex in any way whatever. The action of the different sexes in the presence of the fresh eggs is positive evidence, however. While the males will pay no attention to the eggs, the females—as soon as they have become accustomed to their new location—will busily examine a number of the eggs, crawling over them and tapping them with the antennæ, and finally selecting some for oviposition. One egg after another will then be parasitized. The writer found it most convenient to place two or three females in a tube containing about fifty eggs. One female to about twenty-five host eggs may be correct.

In transferring the parasites from one tube to another, it was found best to place the tubes on a smooth white surface so that the insects might easily be observed. A plate of glass five by seven inches, with a piece of white paper glued to the underside, was used for this purpose. The plate of glass was placed on a table before the worker. At the worker's right hand was a very fine camel's hair brush, a fine insect pin, and a watch glass containing the sugar solution. The parasite tubes were placed at the left of the worker. A few parasites were allowed to come out on the glass plate, and they were then made to walk or jump into the proper tube, which was held open before them. If necessary, the parasites were touched *very slightly* with the camel's hair brush so as to make them go in the right direction. Occasionally, a parasite would escape, but after the operator acquired some experience there was little loss.

Another way to transfer the parasites from tube to tube is to open the two tubes and hold them mouth to mouth. The tubes should be of the same size, and the mouths should be held firmly together. If there are a large number of parasites in one of the tubes, however, too many will usually go into the new tube. In this work advantage should be taken of the fact that the parasites will ordinarily go toward the source of light. The tubes should be arranged so that the parasites will proceed from the old tube to the new one in the direction from which the light comes.

The tubes should be kept in a suitable tray on a piece of white paper, so that the parasites may be observed. A small label bearing a num-

ber may be glued to each tube so that a record may be kept of the work.

For shipment, the tubes containing parasitized eggs may be packed in pasteboard mailing cases. In the work with which the writer was connected, a little cotton batting was placed in each tube to prevent the eggs from shaking, but Mr. S. Leefmans, who received the eggs in Holland, suggested that pieces of very thin paper be used instead of cotton, as the parasites on emerging were liable to become entangled in the cotton. The writer does not know whether the thin paper was more satisfactory than the cotton. Each tube should be packed in cotton in a tube that is somewhat larger, and the larger tubes should be packed in cotton in the case. If cold storage is used—and it is desirable for long shipments, such as across the Atlantic—care should be taken not to remove the insects from the cold storage room at destination and to subject them suddenly to a much higher temperature. The mailing cases should be transferred from the cold storage room to thermos jars, in which they may be carried to the laboratory. They should be left in the thermos jars for about twenty-four hours, in which time they will gradually have come to the temperature of the laboratory. The temperature of the cold storage rooms on the ships used by the writer was said to be 38° F. The freshly parasitized eggs, packed as above, were sent by ordinary mail from Brownsville, Tex., to New York, where they were supposed to be placed in cold storage immediately by the steamship company. The several days during which they were on the road between Brownsville and New York gave the eggs time to turn black before being placed in cold storage.

Perhaps the most important point to be realized by an entomologist who undertakes to rear *Trichogramma* and other egg parasites is that such minute insects require special treatment because of their small size. The cages designed for them, the methods of feeding, shipping, etc., must all be considered with due regard to this factor.

Several entomologists of the writer's acquaintance are now engaged in work in connection with the control of certain injurious insects by the introduction or the artificial propagation of small hymenopterous parasites, and it is hoped that these and other workers may find some helpful suggestions in this article.

THE PERUVIAN FRUIT-FLY (ANASTREPHA PERUVIANA N. SP).

By Charles H. T. Townsend

Wormy fruits have long been known in the Peruvian coast region from Piura on the north to Lima and the southern provinces. The injury seems most acute during the month of February, at the time when the peaches, guavas, cherimoyas and other fruits are largely ripening. The fly is a general fruit pest, attacking not only deciduous fruits but citrus fruits as well. Peach and guava trees are often so completely infested that it is impossible to find a single sound fruit on the tree at times during February.

On February 17, 1912, the writer found in the Chira valley at Sullana, Peru, a guava tree in full fruit, bearing hundreds of beautiful large ripe fruits without a blemish so far as could be seen from the outside. Every fruit of many dozens opened contained trypetid maggots about the size of the Morelos orange-worm. Not an uninfested fruit could be found. The fly was seen on the fruits at that date. A number of these guavas were put in a box to rear the fly. Maggots began issuing from the fruits February 21, and flies issued from March 4 to 10. As indicating distinctness of generations in this fly, at least in this instance, it may be noted that on March 2, 1912, the same guava tree just referred to, having dropped the infested fruits of the preceding month and developed new fruits, showed on careful search only one infested fruit containing one small maggot, all the other numerous fruits being perfectly sound and uninfested.

As the species appears to be undescribed, a characterization of it is presented below. Its distinctness from *Anastrepha fratercula* Wd. may be seen by comparing the descriptions. It is, however, apparently rather closely allied to that species.

Anastrepha peruviana n. sp.

Length of female to end of ovipositor, 7 to 8 mm.; male, 6.5 to 7 mm.; wing, 6 to 6.5 mm.

Description of fresh specimens—Whole head, pleuræ, proximal half of venter and legs pale watery lemon-yellow; antennæ and proboscis with a buff-yellow tinge; tibiæ and tarsi appearing slightly dusky from the thick fine dark pubescence. Pleural plates, especially mesopleural and sternopleural, largely rufous-yellow tinged. Eyes bright green, shading to lilac-purple. About the same shade of light lemon-yellow or greenish-yellow as the occiput, face and front, or very slightly more deeply yellow and with an enameled effect, are the following:—Humeri; short pleural vitta stopping just before wing-base and confluent with humerus; lateral mesoscutal vitta behind transverse suture reaching scutellum; median mesoscutal vitta linear in front but suddenly widened behind, not reaching scutellum; and whole of scutellum; all these having an enameled faint greenish tinge. Rest of mesoscutum pale brownish-

rufous; metanotum same color, with a conspicuous deep brown or almost black wide lateral border showing like two vittæ; tergum of abdomen and ovipositor distinctly rufous-tinged but much lighter than mesoscutum, the hind edges of segments yellow in distinct fasciæ.

Wings marked with rufous-yellow and fuscous; a fuscous inverted V extending from third vein to hind margin of wing, its proximal arm enclosing the hind crossvein, just in front of which the arm becomes yellowish; fuscous and yellow band along costa from tip of apical cell to nearly opposite small crossvein, the color passing obliquely across wing over small crossvein to the narrowed and pointed tip of anal cell, thence diffused over most of basal half of wing leaving clear only the second basal cell, proximal end of discal, large area beyond middle of first basal, subtriangular area from distad of end of first vein to proximad of front end of small crossvein, two axillary lobes inside of anal cell, and less clearly the second costal cell; the color being largely yellowish narrowly edged with fuscous, the fuscous broadened in third posterior cell. First vein wholly spined, third vein spined to slightly or well beyond small crossvein. Apical cell narrowed by the fourth vein curving roundly costad just before reaching margin.

Abdomen of female wide and short, noticeably wider than long; ovipositor fully as long as abdomen, about three times as long as mean width, slightly narrowed posteriorly. Abdomen of male nearly twice as long as greatest width, gently narrowed posteriorly. Four bristles on scutellum, six on hind portion of mesoscutum, lateral ones on mesoscutum and pleuræ; five inwardly directed small bristles on parafrontals anteriorly, behind them two reclinate bristles beside the two vertical bristles on each side. Front of female hardly or nearly as wide as one eye, that of male slightly narrower, face widening evenly below from front.

Dried specimens are obscure tawny or pale dilute brownish on all except the enameled yellow portions, which last show as nearly white; while the abdomen is often distorted from its normal form as shown in the fresh specimens.

Type, female, collected at Chosica, Peru, 2,800 feet altitude, March 11, 1913. Description compared with dried specimens of both sexes reared from guavas collected at Sullana in the department of Piura, Peru, February 17, 1912, the flies having issued from March 4 to 10.

As a remedy for this fruit-fly the writer has advised a spray modeled after the Mally fruit-fly spray used in South Africa, applied to the foliage before the fruits begin to ripen or as soon as the presence of the flies is noted. The formula most convenient for use in Peru is lead arsenate 5 to 10 pounds, chancaca (brown or black cane sugar in cakes) 25 to 50 pounds, and water 100 gallons. The chancaca needs to be dissolved in boiling water before adding to the arsenate solution. The variation in the amount of arsenate is for regulation to different kinds of foliage, guava and orange standing much more than peach; while the sugar content should be increased in the same proportion with the arsenate.

A HISTORICAL ACCOUNT ON THE USE OF KEROSENE TO TRAP THE MEDITERRANEAN FRUIT FLY (CERATITIS CAPITATA WIED.)

By HENRY H. P. SEVERIN, PH.D., *Honorary Fellow, University of Wisconsin,* AND HARRY C. SEVERIN, M. A., *Professor of Entomology, South Dakota State College of Agriculture and Mechanic Arts*

The economic entomologist, owing to his vast field is compelled at times to recommend measures for the control of insects that are troublesome in his territory, even though he himself or his staff have not put these measures to a practical test. In not exactly rare instances, recommendations for the control of pests creep into text-books, station bulletins and entomological journals, and these measures even if followed out to the letter will be practically worthless in every locality where they are adopted. As an excellent illustration of a worthless recommendation for the control of a pest is the use of kerosene to trap the Mediterranean fruit fly.

Fig. 5. Self-feeding kerosene fountain for the capture of the Mediterranean fruit fly in Western Australia.

In this paper we shall first place before the reader the results of our experiments in attempting to control the Mediterranean fruit fly by means of kerosene traps and then we shall follow this with a historical account of this method of control as practiced or recommended in various parts of the world.

The attempt on our part to control the Mediterranean fruit fly by the use of kerosene traps wired to fruit trees was a complete failure. In one experiment 10 traps were wired in 10 fruit-bearing citrus trees located in different parts of an orchard and in five weeks, 10,239 fruit flies were captured; of this entire number, only 36 were females, the remainder being males. At the end of the five weeks nearly every ripe orange in this orchard had been "stung" by the pest. Trapping the Mediterranean fruit fly with kerosene was carried on for a period of eight months in the Hawaiian Islands in connection with other experiments and the results show that of every 1,000 fruit flies captured only three on an average were females, the remainder being males. After taking Weinland into the field and showing him the methods

which we employed in trapping the pest with kerosene, similar experiments were performed by this entomologist. Weinland (1912, p. 264) found that "the proportion of females to males caught is about 1 to 200." Howlett (1912, p. 413) in experimenting on the effect of oil of citronella on the Trypetid, *Dacus zonatus* Saund., found that of 18,000 specimens captured with this oil, "not more than 50 females were seen, or 0.3 per cent" of the total number of insects caught.

One would naturally suppose that the destruction of thousands of males in an orchard would soon lead to unfertilized females, for the opportunity that a female would have of copulating under such conditions would be greatly reduced. But whether or not a male will copulate more than once has not as yet been proven, nor has it been shown that the eggs of the fruit fly will or will not develop without fertilization. Furthermore, it is not to be inferred that all of the males in the immediate neighborhood of a kerosene trap are caught in a few days, for dozens of them may be captured week after week by sweeping among the leaves of the trees with an insect net. Dewar (1908, p. 3) frequently saw Mediterranean fruit flies around the tin containing the kerosene. Some of the flies would rest on the edge of the tin and later fly away without having touched the oil. "It seems clear that the oil caught only a certain percentage of the flies and that the others continued about the tree as usual." This is an observation which we can confirm.

Compere, chief quarantine inspector at San Francisco, has kindly given us the following account of the discovery that the Mediterranean fruit fly is attracted to kerosene. At Guilford, Australia, a farmer's wife had prepared some jam and because the ants were numerous around the house, she set the dish containing the jam on a hitching post to cool. To prevent the ants from crawling up to the jam, she daubed kerosene on the post. Towards evening, the daughter, a girl of eight years, noticed that the Mediterranean fruit flies were swarming around the post and she immediately called her mother's attention to this fact. It was thought at first that the fruit flies had been attracted to the jam, but after the father's attention had been called to the matter he investigated and found that the kerosene had attracted the pest. According to the Sydney *Morning Herald* (1907, p. 645) Devenish who made this discovery, caught 2,000 Mediterranean fruit flies in vessels containing kerosene, in the course of a week in his orchard. According to this account the credit of the discovery that kerosene attracts the Mediterranean fruit fly belongs in part at least to this youthful observer of nature.

In the further history of the use of kerosene to control the Mediterranean fruit fly in Australia, it will be seen that this new discovery

was not put under a severe experimental test by the entomologists before recommending and even forcing the people to use this method.

In Western Australia, Jefferson (1907, p. 162) was the first to report that "some good results have recently been obtained by using kerosene to attract and kill the flies."

During the same year, Compere and Newman (1907, p. 245) both of Western Australia, carried on an experiment with kerosene to trap the Mediterranean fruit fly. A vessel containing kerosene was placed in the forks of a tree and "18 hours later Newman removed and counted 124 fruit flies." No mention, however, was made of the percentage of male and female specimens taken. "*Female flies* removed from the oil showed upon examination to be fertile, being yet full of eggs." It was probably this last statement that influenced some entomologists to take it for granted that many female flies were attracted to the kerosene. This is shown through the interpretation of the above results by Quinn (1907, p. 12) of South Australia who writes as follows: "It is significant to note that many of these were females, containing large numbers of undeposited eggs, showing that the attractiveness of the kerosene took precedence over the instinct of egg deposition."

Hooper (1907, p. 696) also of Western Australia issued the following instructions in 1907, to all orchardists and those people who happened to have one or two trees, and these directions were to be enforced that year: "All fallen fruit throughout the orchard must be gathered daily, and all maggoty fruit destroyed by burning or boiling. In addition to these precautions, throughout the summer shallow vessels partly filled twice a week with kerosene must be placed one or more in each tree in the orchard, and shall be kept in or removed to such trees as an inspector may from time to time require."

In his "instructions to fruit growers" he also mentioned that "last season, in one orchard, 1,268 flies were destroyed by means of kerosene in 24 hours," but the ratio of males to females captured was not given.

Hooper (1909, p. 271) writes as follows concerning the results obtained by enforcing the fruit fly regulations during the preceding year: "This year we are very free of the fruit fly compared with previous years; this I put down principally to the compulsory use of kerosene last autumn, and the clearing up and destruction of maggoty fruit." In this same article he again recommends the use of kerosene to control the pest and enters into a discussion of the troubles experienced by the inspectors in compelling the fruit growers to hang tins of kerosene in the trees. He also states that "the trifling cost of kerosene and the little amount of extra labor are covered over and over again by the value of the fruit saved."

Newman (1910, p. 10) speaks very highly concerning the value of kerosene in controlling the pest: "The method of trapping the fly by the use of kerosene placed in bright, shallow, new tins, or better still in white saucers, has proved the most successful artificial method yet discovered and used in this state. . . . Large numbers of the flies have been captured by this simple means, and if consistently and universally used would cause a great reduction of the pest. *Large numbers* of the flies so caught have been examined and found to contain eggs." Newman now adds "large numbers" to his previous statement "female flies removed from the oil showed upon examination to be fertile, being yet full of eggs."

In New South Wales, Allen (1907, p. 546) experimented with kerosene to trap the Mediterranean fruit fly and says that the fly was "caught in quantities" but he fails to mention the number of males and females captured.

Gurney (1908, p. 581) and (1910, p. 425) also of New South Wales tried the kerosene method of controlling the Mediterranean fruit fly and writes, "As many as 200 adults have been captured in a couple of tins within three days." But like Allen he does not state the per cent of males and females captured.

A few South African entomologists also experimented with kerosene to trap the Mediterranean fruit fly and although some experimental work was carried on yet all of these entomologists overlooked the fact that the number of female flies captured in the oil form but a small per cent of the total number of flies caught.

Dewar (1908, p. 3) captured 444 fruit flies in 122 days in two tins containing kerosene, "one placed in, and the other under, a small citrus tree," but no mention was made of the ratio of males to females.

Mally (1908, pp. 3–5) tested the fondness of the fruit flies in captivity for kerosene and certain sweets. He liberated over 1,000 fruit flies in a cage containing two dishes of kerosene and "after six hours only 37 flies had been caught" but no mention was made of the number of males and females captured.

Lounsbury (1908, p. 6) kept a record of the number of fruit flies that he captured in kerosene and in two of the catches he stated the number of males and females removed from the trap. "On January 19 the first fruit fly, a male, was found in the oil; and in the week following three more were taken. Then from January 26 to February 6, five were taken. After that the catch became much better. Between February 6 and 11, 10 females and 12 males became victims. For the next 10 days the total was 19, and for the next week, 15; and from then, February 28 to March 17, the total was 30."

Ehrhorn (1912, p. 4), superintendent of entomology in the Hawaiian Islands, writes as follows concerning the number of male and female Mediterranean fruit flies captured in kerosene traps. "Among the various experiments tried against the fruit fly, the use of kerosene traps has shown that enormous quantities of male flies can be trapped by this method, but so far very few females have been captured." The results of our investigations with the use of kerosene to trap the Mediterranean fruit fly were read in Honolulu before the Agricultural Seminar on November 9, 1911, and January 11, 1912, at which this entomologist was present and yet Ehrhorn has published this result as well as other observations which we announced at these scientific meetings without due credit being given to our labors.

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THE EFFECT OF TIDES AND RAINFALL ON THE BREEDING OF SALT MARSH MOSQUITOES

By P. L. Buttrick, *New Haven, Conn.*

Early in the Spring of 1912 the Civic Federation of New Haven (Connecticut) raised funds for a campaign to control the mosquito nuisance which every summer for many years has given the city a distinction second only to certain places in New Jersey.

The chief species to be controlled was the banded salt marsh mosquito (*Culex sollicitans* Walk.). It was hoped to secure funds enough to ditch all the salt marshes within five miles of the center of the city, but as this was not done it was thought best to use some of the funds to oil areas which could not be drained, thus temporarily keeping down the numbers of the pest.

Early in June the writer was placed in charge of this work, as well as part of the ditching operations. The following is an amplification of part of his report to the New Haven Anti-Mosquito Committee, Inc., of the Civic Federation of New Haven, and is published with its consent. Acknowledgment is due the officials of the Engineer Corps, U. S. Army, stationed at New Haven, for permission to use government tide gage readings, and for many valuable suggestions.

The life history of the salt marsh mosquito was worked out some ten years ago by the late John B. Smith and his assistants. The eggs are laid singly on the salt marsh mud and lie dormant until covered by water, either tide or rain. They then hatch in a few hours; and in from six to fifteen days, according to the temperature, the pupae transform to adults. After hovering about the marsh grass for a day or two they migrate or are blown distances and invade summer resorts, country sides, and cities, making life miserable for the inhabitants. A few return to the marsh or remain in its vicinity and start the next generation.

The marshes where the salt marsh mosquitoes breed are usually flooded at certain periods when the tides rise above the general level, as usually occurs under the new moon. These are called the *perigee* tides. Consequently, shortly after this period, a brood of mosquitoes is liable to emerge. At other periods when the tides are high or when the marshes are flooded by rain other broods may be produced.

In an oiling campaign a knowledge of the time of the perigee tides is of the highest importance as it gives an opportunity for making preparations for controlling the brood following it. To determine this time, if possible, more accurately than can be done by calendar, a copy of the tide tables of the United States Coast and Geodetic Sur-

vey was obtained. These are published annually and predict for the year the time and heights of the tides for certain important harbors on the coasts of the United States. By simple calculations, the predictions can be extended to almost any point on the coast.

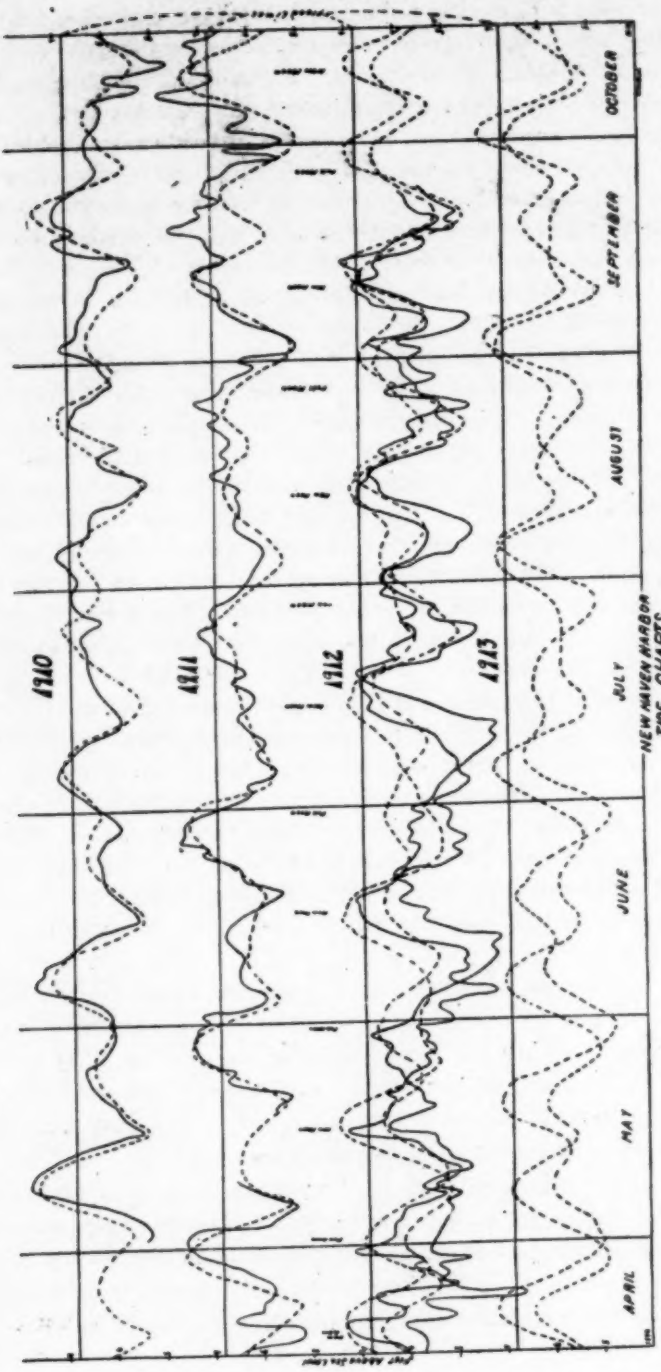
These predictions are obtained by methods of very great complexity which it is not necessary to discuss here. They are highly accurate as to time and reasonably so as to height. Their inaccuracies are due largely to meterological causes which can be predicted only approximately and for a short period in advance. The predictions themselves are based on variation of the astronomical phenomena which cause the tides.

The height of the maximum high tide at a given station for each day of the mosquito season may be plotted on cross section paper and a curve drawn connecting these points. If desired, a second curve may be plotted showing the height of the minimum high tides, for the two tides which occur daily seldom rise to the same height. If both high tides are plotted it will be seen that more regular curves are obtained by crossing the curves on dates when both tides rise to the same height which occurs about every fortnight. On the accompanying chart (figure 6) compare the 1912 and '13 prediction curves, where both tides are plotted with those for 1910 and '11, where only the maximums are given.

Such curves show a variation of nearly half the height of the highest tides, and also that there are more or less definite periods of extreme high tides followed by periods of low high tides. By plotting the phases of the moon on the same sheet, it may be seen that the periods of extreme high tides fall under the new and the full moon. These are called *spring* tides. The periods of low high tides fall under the moon's first and third quarter and are called *neap* tides. The period of highest high water is generally at the new moon and is called the *perigee* tide.

It should be understood that a curve of this kind does not show the daily fluctuation of the water level, only the predicted daily maximums. Curves showing the predicted daily rise and fall may easily be constructed but are of less value, since the discrepancy between the predicted and the actual height for a given day may be quite great, but when distributed over several days is reduced.

After plotting the high tide curves the next point is to determine at what height of tide a given marsh is flooded. There are three ways of obtaining this. First; by setting a tide gage at some convenient point on a stream or in the marsh. The records of this gage will establish a flood line below which the general surface of the marsh is not cov-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AUGUST
SEPTEMBER
OCTOBER
NEW HAVEN HARBOR
TIDE CHARTS
ACTUAL TIDES IN FULL LINES. PREDICTIONS DOTTED.

Figure 6.

ered at high tide but above which it is. This method requires much time and is expensive but is the most accurate in the long run.

Second, to ascertain the general level of the marsh with reference to mean low water; this being the datum plane from which predictions are based. In order to do this it is necessary to use bench marks or points of known elevation with reference to sea level, and work from them. The United States Coast and Geodetic Survey, the United States Geological Survey, and the Engineer Corps, United States Army have each established bench marks along the coast which are supposed to be reckoned from mean low water, which is generally taken as mean sea level, but there may be some discrepancy and, before starting work from a given bench, it should be known that it is referred to the same datum plane as the predictions in the tide tables. Cities, towns, and railroads frequently have established bench marks which are conveniently located, but may be located with reference to high water or an assumed datum. If the correction factor is between them and the low water datum is known they may be used; otherwise, unless a line connecting them with a bench referred to mean low water is run, they are of no value.

By correspondence with the proper departments at Washington or by appealing to the proper local government officers these points can be determined. After establishing the bench mark a line of levels must be run from it to the marsh and the general level of the latter obtained within a tenth of a foot, as a tenth of a foot more or less in the height of the tide may determine whether or not a marsh will be covered sufficiently to flood the breeding pools. As entomologists are not generally also engineers it may be necessary to turn this work over to an engineer.

By adding a tenth or two of a foot to the marsh level it is possible to predict at what height of the tide it will be flooded. This for convenience may be called the *flood line*. The height of the flood line is not necessarily the height at which a marsh is entirely covered, simply that at which the breeding pools are filled and the grass breeding areas are flooded. In fact, at times the general level of the marsh may be scarcely covered, as the flooding of the breeding places may take place by seepage, leaving the higher parts uncovered. It may be that the height of the flood line will vary slightly from time to time according to the condition of the marsh which possibly acts as a sponge and does not always stand at precisely the same level. This matter would be a fruitful field for investigation.

The third method is to visit the marsh at high tide on different days and determine by observation at what height of tide they are flooded.

Observations at New Haven were made by combining the second and third methods.

By drawing a line across the tide chart at a height corresponding to the height of the flood line it can be seen at a glance when flooding will take place. Working charts used in the office also had the dates marked on the horizontal ordinate and the height in tenths of feet on the vertical ordinates at the beginning of each month. The moons were also plotted. The hour of each high tide might be entered in parenthesis after the proper point on the curve which for clearness is enclosed in a small circle. By exaggerating the vertical scale the differences in the height of the tide for different days are more clearly brought out.

The levels at which different local marshes about New Haven are flooded vary. At South End a tide of 6.5 feet floods some of the lower pools. Other marshes are not flooded until it rises over 7 feet; 6.8 feet seems an average and is used in the calculations for this report. The average rise in New Haven harbor is 6.2 feet, the maximum about 8 and the minimum about 4 feet. The accompanying chart shows the relation of the tides to the flood line for various years. From them we see that occasionally the full moon tides rise above the flood line, thus starting a brood of mosquitoes. It is also evident that the perigee tides may not always rise high enough to start a brood. If every perigee and full moon tide series flooded the marshes, the 6 months from April 15 to October,—the mosquito breeding season for this locality, there would be 12, 13, or 14 broods possible, depending upon the sequence of the moons. Probably this number is never realized. The maximum number shown by the curves so far plotted is 10. This number is indicated on the 1912 curve. The minimum so far shown is 7 for the 1911 curve. Eight is probably an average, curves for 7 years only being available.

With our present knowledge of the time it takes mosquitoes to develop, we can take the first day which a marsh is flooded in a series of high tides and add the approximate number of days necessary for their development and determine within a margin of a day or so when the adults will fly.

It should be understood that temperature conditions, early or late in the season, may be such that breeding is difficult, or impossible; that heavy rains may flood the marshes at other times, producing extra broods; or that winds and other causes may depress the tides and cut out a small brood or raise them when they are near the flood line so as to produce one not scheduled.

The following shows how the August campaign was laid out on a single marsh. On Saturday, August 10, 1912, the maximum high

tide was predicted, as will be seen from the curve, as 6.8 feet. This is sufficient to flood the West River Marshes. Development in ordinary August weather generally takes about one week; hence oiling, to be successful, must be done before the following Saturday night, or *August 17*. It will also be seen that the tides would continue to flood the marsh at least once daily till the end of the week so that oiling would have to be carried on with the tide still on the marsh.

Some idea of the accuracy of the predictions is obtained by comparing the predicted curves with actual tide gage readings plotted on the same sheet in the accompanying figure. Gage readings were obtained from Engineer Corps, U. S. Army, and were taken from tide gages in New Haven and Bridgeport harbors. The 1912 readings were taken from a gage in Bridgeport Harbor and correction factor figured mathematically. This probably accounts for some of the discrepancies. It will be seen that they are of sufficient accuracy to afford a reliable basis for planning an oiling campaign and if checked by gage readings from day to day would be of still greater value.

A given curve shows the periods of maximum high tides for an extended region, probably for all points within the same time belt, and would thus give a rough idea of the number of broods of mosquitoes to be expected in a given season over that territory; but for the actual heights and times of floodings a curve has only a local value. The territory over which it could be used for these purposes depending on the configuration of the coast line which determines the time and height of the tides locally. Thus, an open coast line which the tide wave strikes at right angles will have high water at approximately the same time for long stretches and it will rise to approximately the same height. On a broken coast line with bays, estuaries, fiords, etc., where the tide wave runs parallel to the shore, the time and height will vary greatly. At New Haven, where the tide wave runs parallel to the shore, a single curve only was used, but it is probable that better results would have been obtained if a separate one had been used for some of the outlying marshes. And it is certain that if the campaign had included Branford and Milford, points 10 miles east and west of New Haven harbor, respectively, that at least three curves would have been required.

The predictions are usually given for a certain point, a wharf head, breakwater, lighthouse, or the like. The salt marsh may be some miles away. If further up harbor, an addition sometimes as great as 2 hours must be made for the tide to reach that point. If down harbor, it does not necessarily follow that a deduction is required, as the resistance of the stream bed and marsh surface to the tide wave is great and even here the tide is apt to be at flood later than at the

point where the prediction is made. These points have to be worked out locally and are of chief importance as indicating when the marsh will be uncovered during periods of high tides, as work on them is easier and more effective at that time.

Although rainfall is a factor in the abundance of mosquitoes, it does not necessarily follow that the more rain the more mosquitoes. So far as salt marsh mosquitoes are concerned, the time and size of the individual rains are of great importance. A rain storm occurring when the tides almost reach the flood line may be sufficient to raise the water level so that a brood is produced. At another period when the tide level is low the same amount of rain might be carried off without its first covering the marsh. As near as we can judge at present, it takes a rainfall of at least an inch within 24 hours to start a brood of salt marsh mosquitoes, although rain in any amount, when larvæ are growing, will help to keep the pools from drying and increase the size of the brood. Rain may at times actually prevent breeding. A slight rain may cause the eggs to hatch but not provide water enough for their full development, thus effectually destroying them.

As is seen from the tables, after the first of June the rainfall at New Haven for 1912 was below normal as well as below the precipitation for 1911.

RAINFALL AT NEW HAVEN, CONN., DURING MOSQUITO SEASON.

(From United States Weather Bureau)

	NORMAL	1911	1912
April	3.56	4.31	4.56
May	3.64	0.74	6.34
June	3.17	2.73	0.50
July	4.78	2.17	2.14
August	4.99	5.57	3.22
September	3.79	2.33	2.32
October (1st to 15th)	1.83	2.12	.11

However, the rains in 1912 were largely at such times as to aggravate mosquito breeding. Starting with April, there were heavy rains about the 29th which increased the size of the second brood of the season. On May 16, at the height of the perigee of that month, it rained 2.85 inches. During June, not enough rain fell at any one time to affect breeding conditions. On July 21, just as the last of the July brood was emerging, we had nearly an inch of rain, which served to provide enough water to allow the fag end of the brood to

escape where oil had not been applied. From August 10 to 25, during the August perigee, 2.85 inches of rain fell, an amount ample to provide a brood on its own account. At the time of the first September brood it rained in all 0.95 of an inch, enough to materially increase the size of that brood. All in all, rain-fall conditions in 1912 decidedly favored an abundance of salt marsh mosquitoes about New Haven.

Investigations along the line of the relations of the tides and rainfall to breeding of salt marsh mosquitoes are far from complete, and offer an interesting opportunity for the investigator looking for a chance to increase our knowledge of the obscure physical causes which influence the varying abundance of life on our planet. Such an investigation would in the end pass out of the field of the entomologist into that of the engineer, or physiographer and the geologist, according as stress was laid on the tides or the marshes, but there is room for much more investigation on the purely entomological side.

NOTE ON THE FLOWERING AND FRUITBEARING OF YUCCA ALOIFOLIA IN SOUTH AUSTRALIA

By J. G. O. Tepper, *Norwood, South Australia*

Twenty years ago the writer contributed a short note to *Insect Life*, 1892 (Vol. IV, p. 74), when he first observed sound, but then still immature fruit at a distance from Adelaide of 30 miles; this struck me as singular on account of its dependence upon a highly specialized moth, endemic as well, in the American home. Excess of office work prevented me from investigating the problem personally as to the pollination of the Yucca in this state, there being no plants accessible to me, and the few other South Australian lepidopterologists were probably in a like fix, for nothing so far seems to have been done to discover the insect agent. However, a year or two later I acquired a young shoot of the fruiting species of Yucca, and planted it in my own back garden, where it prospered and grew, but did not flower for many years.

Three years ago, however, when the tree had attained a height over eight feet, it developed its virginal flower spike, but this set no fruit. Last year (1911), however, it produced two opposite branches near the crown, and both of these developed flower spikes, one a month in advance of the other. Of these, while the earlier one was in flower, but still bore buds, and the later only immature buds, I managed to take a photograph (Pl. 8, Fig. 1), December 22, 1911, of the crown with some difficulty. The older spike (right side) remained sterile, although

some of its late flowers were still open, when the younger one was in full flower a month or so later. The crown of the tree was now about 10 feet above the ground.

Ten fruits were developed by this younger spike and first noticed during February to March of this year (1912) although I am not aware of any other Yucca specimens existing within several hundred yards of mine. The flowers continued for from two to three months, and their shrivelled remains persisted much longer, while the fruits grew extremely slowly, attaining to proximate ripeness during October only. On the 3d of that month a photograph (Pl. 8, Fig. 2) was taken of the top of the tree, and in nearly the same direction as No. 1 (looking south) but from two feet distance with a portrait lens attached to the camera ("Brownie No. 2"), and showing the fruit from the north (*i. e.*, sunny) side. On the 9th, I cut out both spikes, and photographs were taken showing them from the reverse side (Pl. 8, Fig. 3). Some of the fruits were now soft and overripe, and one cut open a few days later was found too far gone for the detection of insect remains, the soft pulp being purple-veined. This fruit, one of the largest, contained 138 flat, black and perfectly ripe seeds and a much less number of small, thin, white ones, mostly located at and near the stalk end. The size of these varied from under three to over four inches and I remit two as samples for examination by experts[1] for external marks of insect agency, comparison with American fruits, etc., by separate parcel, and also a few of the peculiarly shaped seeds. These appear to me to resemble tick species in color and form, which may possibly assist in their distribution by birds feeding upon those animal parasites, and which, deceived by color and form, swallow them, and pass them softened with their excrement.

In Professor Riley's response appended to my note in 1892 (*Ins. Life*, IV, 74) reference is made to certain characteristics of the leaves being required for the determination of the species. The leaves of my tree are 20 to 23 inches long, ¾ to over 1½ inches wide, very rigid and most acutely pointed, the upper side concave and smooth, the margins minutely rough-edged, forming crowded spirals near the crown. The older leaves bend backward and are finally closely adpressed to the trunk and long persistent when dry. The trunk of the tree is now fully six inches in diameter, and the total height, inclusive of the three branches, over ten feet.

Thus far then as my observations go, it took about 16 years in the

[1]Mr. August Busck, at the request of Dr. Howard, examined the specimens and found no evidence of insects. The specimens were very moldy and further comparisons were impracticable.—*Ed.*

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Yucca Flowers and Fruit

locality before the first flowers were developed, but these without yielding fruit. The floral spike terminating the central axis of growth, two lateral opposite branches developed, but it took two years before the second set of flowers appeared, one spike being a month in advance of the other, and of which the earlier one also remained sterile while the later one produced a small number of fruits, that is, became pollenized by some agent adapted for that purpose, during January or February, the hottest summer months in South Australia. To complete the cycle of budding, flowering, fruit-setting and ripening it required about a full year, and likewise the cycle of the metamorphosis of the fertilising insect from the egg, through the larval and (probably) pupal stages, passed within the slow growing fruits. Considering the absolute interdependence of plant and insect, the fruiting here, so far from their endemic home is very remarkable in this case, and appears to be explicable in two ways only, both equally problematical. The first is that *Pronuba yuccasella* larvæ were introduced with or imported with Yucca fruit to an Australian locality, where flowering Yucca trees existed when the imagines emerged from the pupal shell, in or near the fruits in which the eggs and larvæ developed.

The second alternative is, that an Australian insect exists possessing similar organs, *viz.*, prehensile maxillary appendages and long, extensible boring ovipositor, as the Pronuba, which has yet to be proved. I have not yet come across any evidence that either of the above alternatives has been investigated, and probably no person even lives now that could assist in proving the introduction theory.

EXPLANATION OF PLATE 8

1. *Yucca aloifolia* budding and flowering spikes, looking south, south west.
2. Ripe fruits, trunk 10 feet high, looking south.
3. Sterile and fruiting spikes, detached and shown from the reverse side as seen in figure 2.

FALL ARMY WORM

Laphygma frugiperda (*S.* & A.)

By J. A. Dew, *Field Entomologist, Auburn, Ala.*

The purpose of this paper is to set forth the facts in regard to the fall army worm which were determined during the outbreak last year. Owing to the fact that previously there has been little investigation concerning this species and because the worms are present in local areas again this year, it was thought best to give in condensed

form the results of the investigations and experiments conducted by the Alabama Experiment Station from May until December, 1912.

During the course of the work conducted last year, the following food plants of *L. frugiperda* were observed. They are arranged below in order of apparent preference by the larvæ: crab grass, Bermuda grass, blue grass, Johnson grass, corn in the bud, corn in the ear, sugar cane, bud and tender leaves, sorghum, millet, Kaffir corn, oats, wheat, cowpeas, sweet potatoes, velvet beans, soy beans, peanuts, string beans, cotton, Irish potatoes, bell pepper, turnips, rutabagas, pecan foliage, satsuma orange foliage, cockle burs, Alabama clover and briars (Solanaceæ). The only common plants observed upon which no larvæ were ever seen feeding were those of the Cucurbitaceæ family, watermelon, squash, pumpkin, etc.

Seasonal History.—The first appearance of adults recorded in Alabama was on May 4, 1912. This record was made in Mobile by Mr. H. P. Loding of that city. Following close upon the appearance of the moths, about May 15, came reports of ravages by the larvæ in the Mobile district particularly, and also from other South Alabama points. General pupation occurred from May 20 until June 1. The first week in June, however, brought an army of larvæ which wrought great destruction to the field crops. The life cycle was completed again during the next 30 days and in July the infestation was state wide. Two other generations were completed, one in August and one in September. By this time, through migration of the moths and attacks of natural enemies, the pest had practically disappeared from this state. Occasional larvæ were found in October and November. Specimens have been observed in hibernation in the larval, pupal, and adult stages, about 80 per cent appearing as pupæ.

Life History.—The detailed life history of *L. frugiperda* is very similar to that of some other members of the family Noctuidæ. As before suggested, the life cycle, under average summer temperatures, requires a period of some 30 days. The eggs are deposited by the female during the early part of the night (before 10 p. m.) in clusters containing from 60 to 500 eggs. These are usually placed upon the leaves of corn and cotton plants, blades of grass and other vegetation which will be suitable food for the young when they appear, but sometimes are to be found upon the leaves of pecan trees, orange trees and any forest trees which may be near the fields. The eggs may be deposited in two, three and sometimes four layers or decks when the cluster is especially large. After oviposition, the female covers the mass with a mouse colored down composed of silken threads and of scales from her body.

The eggs hatch in from two to four days, usually three days, depending upon the prevailing temperatures. The newly hatched larvæ make their first meal of the egg shells, avoiding the downy covering, and then lie close together for two or three hours, apparently resting and gaining strength before seeking other food. After the rest period a wholesale migration takes place, and the larvæ actively search in all directions for available food tender enough for their mastication. At this period of life their strength and ability to travel is remarkable, Mr. W. F. Turner having observed such larvæ to travel a distance of 15½ feet in one hour.

As soon as the young find suitable food, the general migration ceases and the larvæ settle down to feed upon the plant tissues, skeletonizing the tenderest foliage that is to be found. In about 24 hours the caterpillars cast their skins entering the second stage of their development, there being little difference except an increase in size. In another 36 hours the skin is cast again and now the marks which are typical of the full grown larva begin to appear faintly. In this third larval stage the specimens are about one half inch in length, are quite active and voracious feeders. The time spent in this stage is about 40 hours, the stripes and marks becoming more prominent before the skin is cast the third time. The fourth stage, lasting usually two and one half to three days is especially prominent because of the attainment of the typical marks and stripes of the full grown worm and the distinct appearance of the inverted "Y" in the face. There is scarcely any difference in appearance of larvæ of the fourth and fifth stages except in size and length. After casting their skin the fourth time, the larvæ attain a length of about seven eights of an inch.

During the fifth and sixth or last larval stage, the greatest damage is done. The worms are voracious feeders and appear to be unusually resistant to the effects of arsenical poisons. The fifth and sixth stages extend over a period of seven days when the larvæ, usually one and one fourth inches long, enter the soil near their food plant and form cells in which the transformation to pupæ takes place. In a stiff clay soil the pupal cells are usually three fourths of an inch long and lie at an angle one half inch below the surface. In loose sandy or loamy soils the cells are usually one inch long and are buried to a depth of one inch.

After the pupal cells are formed, the larvæ spin a weak cocoon composed of coarse silk binding together particles of soil. While the process of cell formation is going on, a gradual change takes place in the larva and at the end of 36 hours the pupa, varying from five eighths to three fourths of an inch in length, is complete, lying

in the cell. The time spent as pupa varies from three to sixteen days, the average being ten, and in the case of the specimens observed, the adult always emerged at night.

Mating, as a rule, takes place within the 36 hours following emergence and during the next 36 or 48 hours eggs are deposited for the next generation. The number of eggs deposited by one female varies from 160 to 700 with an average in the several cases observed of 450. These, as a general thing, are laid in two clusters, both during the same night, while a few scattering groups of four or five may be deposited the following night. The adults die in from four to eight days; the eggs hatch in from two to four days; the young larvæ begin their work of destruction and the life cycle is complete.

As determined in the insectary and checked by observations in the field, the life cycle was found to cover a period of 30 days when the mean temperature is 78°F. The time spent in the various stages of development is as follows: egg, three days; larval stage, 14 days; pupal stage, ten days, together with the three days necessary for mating and oviposition; total, 30 days. The figures given are the averages secured from the rearing of large numbers of individuals. Naturally there was a great variation, some specimens requiring 40 days while others completed the life cycle in 21. During the five months from May to September inclusive, there were five generations in the field, thus showing a field average of 30 days.

Observations made in the field during October and November showed 90 per cent of the eggs deposited during this time to be nonfertile. Larvæ collected in September and placed in breeding cages for further study were all destroyed by natural enemies, which by this time had become so numerous in the field that practically all specimens were parasitized. These two facts render inconclusive the evidence as to future generations, although occasional larvæ were found during these autumn months.

Natural Enemies.—Before the first generation of worms entered the soil in May for pupation, Tachinid flies and other parasites and predaceous enemies put in their appearance. While located at a temporary field laboratory at Irvington during August, 30 natural enemies were found preying on Laphygma. Of these, 21 were predaceous enemies and nine were parasitic. Of the predaceous enemies eleven were Coleoptera, four were Hemiptera and six Hymenoptera. The two most effective of the beetles were (*Tetracha carolina*) a tiger beetle and (*Calosoma calidum*), one of the ground beetles. The two most common of the true bugs which were preying upon the species belonged to the family Reduviidæ and have not as yet been determined. The solitary wasps were very effective in their work,

the two present in the largest numbers being *Polistes canadensis* and *Pelopœus cementarius*.

Nine true parasites were bred, four being Dipterous and five Hymenopterous. *Nemorea leucaniæ*, a Tachinid, and *Sarcophaga georgiana*, one of the Sarcophagidæ, were the most common of the Diptera. The parasitic wasps were of two families: Braconidæ and Ichneumonidæ, the most destructive species being *Eniscopilus purgatus*, a large yellow Ichneumon fly.

At various times during the season the following birds were observed feeding upon the worms, arranged in order of their effectiveness:—quail, field larks, common crow, mocking bird and English sparrows. Turkeys and chickens naturally fed on the worms near habitations. Early in the season small green tree frogs would secrete themselves in the bud of corn plants, capturing and feeding on unsuspecting moths which would be in hiding.

CONTROL.—Two methods of artificial control were found to be effective, mechanical and arsenical. Nearly a hundred experiments were conducted during the year with varying results. From these experiments the following conclusions can be drawn.

First. A light shallow cultivation with either harrow or sweep during the period of pupation will turn up from 10 per cent to 50 per cent of the pupæ. Ordinary summer heat at the surface of the ground (120°F.) will kill the pupæ in 20 to 30 minutes.

Second. When the larvæ assume the army habit of travel, rolling with a heavy roller is ineffective except on hard ground. A heavy log, dragged up and down in a furrow, in the path of the advance is effective.

Third. Arsenical Control.—Arsenate of lead, powdered, used at the rate of 1½ pounds to 50 gallons of water was effective when applied to plants so that larvæ would reach it. Arsenite of zinc used at the rate of 1 pound to 50 gallons of water was also effective. When an "ortho" Arsenate of Lead was used, there was no injury to any of the food plants. Acid or 'meta" arsenates of lead gave burning in some cases unless lime was added. Arsenical control was obtained in young corn, only when the spray solution was forced into the bud. Dusting of the poisons was not effective except on plants having a broad lateral leaf surface as cotton, cowpeas, etc.

Poison bait was ineffective in the majority of cases. Early in the season when the fields were clean of grass and weeds and the larvæ spent the day in the soil, coming up at night to feed, the poison bran mash killed large numbers when placed at the base of young corn or cotton plants.

Fourth. Moths can be trapped at lights from dusk to 11 o'clock

p. m. About 50 per cent of those captured will have already deposited eggs.

Fifth. While in tropical and sub-tropical latitudes larvæ may be found all the year round, there is little doubt but that in this latitude the species winters as pupæ. Fall and early winter plowing, therefore, should reduce the number passing the winter successfully

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AN ANNOTATED LIST OF THE LITERATURE ON INSECTS AND DISEASE FOR THE YEAR 1912

By R. W. DOANE, *Stanford University*

During the summer of 1911, Brues and Sheppard made careful studies of the insect life in the environment of recent cases of acute epidemic poliomyelitis. Their findings led them to believe that *Stomoxys calcitrans* might be concerned in the transmission of the disease. At one of the sessions of the Fifteenth International Congress on Hygiene and Demography September 26, 1912, Dr. Rosenau announced that six out of twelve monkeys exposed daily for several weeks to the bites of numbers of Stomoxys which had been allowed to feed on other monkeys that had been inoculated with poliomyelitis virus, became sick and showed symptoms of poliomyelitis. This announcement has created profound interest in all medical and entomological circles and has led to a long series of investigations by physicians and entomologists. In October, 1912, Anderson and Frost of the United States Public Health Service repeated these experiments and their results seemed to confirm the findings announced by Rosenau. The results of no other experiments have yet been announced and it remains to be shown whether this is a usual method of transmission in nature. References to only a few of the most important of the many articles and comments on this subject are given in the following list.

The Simuliidæ, too, have continued to receive a great deal of attention on account of their possible relation to pellagra. Forbes, Hunter and Garman have made detailed studies of the Simuliidæ of Illinois, Kansas and Kentucky respectively and while they find much in support of Sambon's theory, the fact that these flies are really the carriers of the virus that causes the disease has been by no means proven.

A small outbreak of plague in Cuba again awakened the people, particularly on the Gulf and Atlantic Coast, to the necessity of keeping the seaport towns as free as possible from rats.

The name of another martyr to scientific medicine was added to

the list when Dr. T. B. McClintic of the United States Public Health Service died in Washington after having contracted Rocky Mountain spotted fever while investigating the disease in Montana. Dr. McClintic was regarded as the leading authority on this disease.

A man better known to all entomologists was Prof. J. B. Smith, who died in New Brunswick in March, 1912. His work in nearly all the fields of applied entomology, and his long list of important publications, caused him to rank as one of the very foremost of American entomologists. Within recent years his work on mosquitoes and mosquito control has been of particular interest and importance.

Among the many articles on malaria and mosquitoes one or two deserve special notice. A. J. Orenstein gives an instructive article entitled "Sanitary Inspection of the Canal Zone" in Amer. Jour. Pub. Health, Vol. II, March, 1912, in which he describes the successful fight being made there against malaria, yellow fever, plague and typhoid. Much interest has been taken in the experiments first successfully carried out by Drs. Bass and Johns, wherein *Plasmodium vivax* and *P. falciparum* were grown in cultures through one or more generations.

Considerable attention has been paid to the possibilities of flies carrying bacteria. Dr. J. C. Torry, in Jour. Infec. Dis. March, 1912, shows that as many as 4,400,000 organisms may occur on the outer surface of the fly and that 28,000,000 may be found in the intestine. From 13 per cent to 37 per cent of these were found to be fecal bacteria. Cox, Lissant, Lewis and Glynn report that flies in insanitary city areas may contain 800,000 to 500,000,000 bacteria per fly. Tebbutt concludes that the possibility of flies becoming infected from the presence of pathogenic organisms in the breeding ground of the larvæ may be considered as very remote. In another series of observations Hewitt finds that 700 yards was the greatest distance that houseflies flew from the places where they were marked.

The principal interest in the study of the sleeping sickness situation has centered around the papers by Kinghorn and York, Stevens and Fantham and others who believe that *Trypanosoma rhodesiense* is distinct from *T. gambiense* and that *Glossina morsitans* is the carrier. This of course greatly complicates the problem of controlling this disease, as *G. morsitans* has a much wider range than *G. palpalis*.

In July, 1912, the Tropical Disease Bureau ceased to publish the Sleeping Sickness Bulletins and in November began the publication of the Tropical Diseases Bulletin which will include reviews of literature on other diseases as well as of Sleeping Sickness.

Once more I wish to point out that the following list makes no claim to completeness. It includes references (with a few exceptions)

only to American and English journals, most of which are available to many physicians and entomologists. An attempt to include even the most important of the continental papers would extend too greatly the scope of this article.

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Balfour A. Mosquito and river vessels. Lancet, Lond. April 20, 1912, I, 16, pp. 1048, 1051. Believes that such vessels may carry many mosquitoes and suggests methods of control.

Britton, W. E. The mosquito plague of the Connecticut coast region and how to control it. Conn. Agric. Exp. Sta. Bull. 173, July 12. Methods of control and results expected.

Britton, W. E. Mosquito control work in Connecticut in 1912. Jour. Econ. Ent. Vol. 6, No. 1, Feburary 1913, pp. 89–93. Methods of draining, oiling, etc. and results.

Darling, S. T. A mosquito larvicide-disinfectant and methods of its standardization. Amer. Jour. Pub. Health, Vol. II, No. 2, February, 1912. The mosquito larvicide used by the Sanitary Department of the Canal Zone is made of crude carbolic acid of a specific gravity not greater than 0.97 and containing not less than 30 per cent tar acids. One hundred and fifty gallons crude carbolic acid heated in iron tank, 200 pounds finely crushed and sifted rosin dissolved in this and then 30 pounds of caustic soda that has been dissolved in 6 gallons of water are added. Stirred thoroughly for a few minutes. Cost, in large quantities, 14 cents per gallon. For mosquitoes use 1 part to 5 parts of water and apply with spray pump, kills in 3 to 5 minutes, loses effect after about 7 days. Pupa more resistant, not always killed. Kills Algæ and Protozoa also.

DYAR, HARRISON G. Distribution of mosquitoes in North America. Proc. 7th Inter. Zoöl. Cong. p. 957. (Paper read 1907, pub. 1912.) Brief abstract.

EDWARDS, F. W. Notes on the British Mosquitoes (Culicinæ) The Ent. XLV, July, 1912. Synopsis of the genera and notes on the species.

GUNASEKARA, S. T. Potassium cyanid as a larvicide. Brit. Med. Jour. 1912 No. 2678, p. 981.

HOWARD, L. O. Bats vs. mosquitoes. (Letter from Hiram Byrd.) The Can. Ent. Vol. XLIV, No. 8, 1912, p. 231. Does not believe that bats even in great numbers affect the number of mosquitoes in a locality.

JENNINGS, ALLAN H. Some problems of mosquito control in the tropics. Jour. Econ. Ent. Vol. 5, April, 1912, pp. 131–141. Notes on habits of the species. Methods of control, crude oil and "larvicide" spread with spray pump or drip barrels; killing adults in houses, bottles and "swatters."

KNAB, F. A proposal for the control of certain mosquitoes. Science XXXVII, No. 943, January 24, 1912. Only a few mosquitoes hibernate as adults. Most of them, particularly in woods and swamps, pass the winter in the egg stage. As these eggs are laid on leaves and rubbish it is suggested that the best method of control would be to gather such rubbish and burn it or place it where it could not get back into pools of water.

MCCOY, G. W. Honolulu rice plantations and mosquito breeding. Pub. Health Rep. April, 12, 1912, XXVII, 15, p. 536. These plantations often serve as breeding places. Liberal flooding and stocking with fish is recommended. (See also Nos. 3, 17 and 26 of the same volume.)

MCMILLAN, M. Use of fish as sanitary measure to eliminate mosquitoes. Amer. Jour. Pub. Health. II, No. 9, September, 1912.

NICHOLLS, L. Some observations on the bionomics and breeding places of Anopheles in Saint Lucia, Brit. West Indies. Bul. Ent. Res. Vol. III, pt. 3, November, 1912, pp. 251–268. Points out the importance of being sure of the sources of the mosquitoes before applying kerosene or other substances to the water.

ORENSTEIN, A. J. Sanitary inspection of the Canal Zone. Amer. Jour. Pub. Health, Vol. II, March, 1912, pp. 145–156. Organization of force, Anti-malarial work, elimination of breeding places of Anopheles, destruction of larvæ, destruction of adults.

Anti-yellow fever work, *Stegomyia* not allowed to breed.

Anti-plague work, quarantine and campaign of rat destruction.

Anti-typhoid and anti-dysentery work, water supply kept pure, particular precaution against flies, no breeding places allowed. Details of all of these methods are given. (Important.)

SEIDELIN, HARALD. A note on the nomenclature of *S. fasciata*. Yel. Fev. Bul. Vol. I, No. 11, March, 1912. Shows reasons why this name should stand.

SMITH, JOHN B. Ridding a state of mosquitoes. Proc. Inter. Zoöl. Cong. (7th.) pp. 662–663. (Paper read August, 1907, pub. 1912.) Brief account of work in New Jersey.

STANTON, A. T. On the changes which occur in certain characters of Anopheles larvæ in the course of their growth. Bul. Ent. Res. Vol. III, pt. 4, December, 1912, pp. 387–391. Finds that the heretofore supposed variations are due to different stages of development.

THEOBALD, F. V. The distribution of the yellow fever mosquito (*Stegomyia fasciata*) and general notes on its bionomics. Int. Ent. Cong. II, pp. 145–170.

WEISS, HARRY B. AND PATTERSON, R. S. Revised keys to the species of

mosquitoes and mosquito larvæ found in New Jersey. Ent. News, Vol. XXIV, No. 2, February, 1913, pp. 65–72. Tables for determining adults and larvæ.

WISE, K. S. AND MINNETT, E. P. Experiments with crude carbolic acid as a larvicide in British Guiana. Ann. Trop. Med. & Par. Vol. 6, No. 3, B. October 18, 1912. pp. 327–330. Found paraffine and petroleum useless because they blow to one side, must use a soluble form of larvicide. Crude carbolic, a teaspoonful to every 2 cubic feet of water or one oz. to 16 cu. ft. is recommended.

WISE, K. S. AND MINNETT, E. P. Experiments with crude phenol as larvicide in British Guiana. Ann. Trop. Med. & Par. VI, No. 3, October 18, 1912. Crude phenol, 1 to 20,000, kills all larvæ but not pupæ in 2 hours, becomes more concentrated as pool dries up and may impregnate the ground so that the water that collects there later will be unfit for mosquito larvæ.

MALARIA

BASS, C. C. AND JOHNS, F. M. The cultivation of malaria plasmodia (*P. vivax* and *P. falciparum*) in vitro. Jour. Ex. Med. XVI, No. 4, October, 1912. These species grown in cultures through one or more generations. Sexual cycle not grown. Reviews and notes on these experiments occur in Jour. Ann. Med. Assn. September 21, October 12, 1912. In the N. Y. Med. Times, June, 1912 and in many other places.

CARTER, HENRY R. Anti-malarial measures for farmhouses and plantations. Pub. Health Rpts. Vol. 27, No. 49, December 6, 1912, pp. 2024–2030. Emphasizes the importance of controlling the human and insect host.

CELLI, A. Reduction of malaria in Italy. Policlinico, Rome. Government distributes quinine practically gratuitously. By this and other means excellent results secured.

CHRISTOPHERS, S. R. Malaria in the Andamans. Sci. Mem. by Officers of Med. & San. Dpts. Govt. India. New ser. No. 56, 1912. A consideration of the carriers in this region.

FERMI, C. L. AND LUMBAU, S. Können Anopheles-Mücken auf den Menschen Malaria übertragen, ohne sich durch Besuch von Malariakranken verseucht zu haben? Können dieselben sich die Infektion aus anderen Tieren als dem Menschen holen? Centralbl. f. Bakt. 1 Abt. Orig. 1912, July 3, Vol. 65, No. 1–3, pp. 105–112. Conclusions: Anophelines which have not fed on malarial patients cannot infect man; feeding on infected birds or animals other than man, does not make them infective for man.

GRAY, HAROLD FARNSWORTH. Malarial control in California. Amer. Jour. Pub. Health, Vol. II, No. 6, 1912, pp. 452–455. Record of the work since 1910.

STAMMERS, MAJOR AND DAVYS, CAPT. Apyrexial malaria carriers. Jour. Roy. Army Med. Corps Vol. XVIII, No. 3, March, 1912. Some people may carry the malarial parasites without showing signs of the fever.

STRYKE, A. C. The life-cycle of the malarial parasite. Ento. News, Vol. XXIII, No. 5, May, 1912, pp. 221–223. Diagram to show development of parasite in man and mosquito.

THOMPSON, J. G. AND MCLELLAN, S. W. Note by Ross. The cultivation of one generation of malarial parasites (*Plasmodium falciparum*) in vitro, by Bass's method. Ann. Trop. Med. & Par. Vol. 6, No. 4, December 30, 1912. pp. 449–459.

YELLOW FEVER

AGRAMONTE, A. The so-called parasite of Yellow fever. Med. Rec. March 30, 1912, annotation in Jour. Trop. Med. & Hyg. May, 1912, pp. 136–137. Criticism

of Seidelin's article in Yellow Fever Bull. Doubts whether the bodies Seidelin found are parasites.

GUITERAS, JUAN. A false alarm of yellow fever (Cuba) and how it was met by Health Department. Amer. Jour. Pub. Health, Vol. II, March, 1912. pp. 170–173. Buildings where suspected cases were found were covered with canvas and fumigated with sulphur.

LICEAGA, EDUARDO. Annual report on yellow fever in the Mexican Republic. Amer. Jour. Pub. Health, 1912, Vol. II, No. 3, pp. 174–181. Cites a case that he believes does not come within the generally accepted theory of mosquito transmission.

SEIDELIN, HARALD. Yellow fever prophylaxis. Yel. Fev. Bur. Bull. Vol. I, No. 10, February, 1912. Abstract in Jour. Trop. Med. & Hyg. XV, May 1, 1912. Discusses various prophylactic measures but concludes that mosquito destruction is the only radical measure.

SEIDELIN, HARALD. Report of yellow fever expedition to Yucatan 1911–12. Yel. Fev. Bur. Bul. Vol. II, No. 2, October, 1912, pp. 123–124. Contains notes on Stegomyia and its importance.

THEOBALD, F. V. The distribution of the yellow fever mosquito and general notes on its bionomics. Int. Ent. Cong. II, pp. 145–170.

Yellow fever epidemiology. Yel. Fev. Bul. Vol. I, No. 9, June, 1912, pp. 291–293. Several recent isolated outbreaks are inexplicable according to our present actual knowledge. The suggestion has been made that the germs may be found in some other animals, but absolutely nothing to support such a theory.

The outbreak of yellow fever in Yucatan. Yel. Fev. Bul. Vol. I, No. 10, February, 1912, pp. 335–337. Discusses the probable origin of this outbreak.

Yellow fever in 1912. Yel. Fev. Bur. Bull. Vol. II, No. 2, October, 1912. pp. 121–122. Notes on reported cases.

FILARIASIS

BAHR, P. H. Filariasis in Fiji. Jour. Trop. Med. & Hyg. Vol. XV, March 1, 1912, pp. 77–79. Report on a paper read before the Soc. Trop. Med. & Hyg. January, 1912. Cause of the disease, effect on the patient and means of transmission and control.

BANCROFT, THOS. L. The prevention of filariasis. Australasian Med. Gaz. January 27, 1912, Vol. XXXI, No. 4. Annotation in Jour. Trop. Med. & Hyg. Vol. XV, March 15, pp.92–93. Prophylactic measures recommended. Destroy breeding places of *C. fatigans*.

LOW, GEO. C. The life of filarial embryos outside the body. Jour. Trop. Med. & Hyg. Vol. 15, No. 22, November 15, 1912, pp. 338–339.

LEPROSY

CANTLE, J. Our knowledge of leprosy. Jour. Trop. Med. & Hyg. Vol. XV, March 1, 1912, pp. 74–77. Notes on the attention that is being paid to this disease, the possibility of its being transmitted in various ways.

CURRIE, D. H. AND HOLLMANN, H. T. Further observations on rat leprosy. Pub. Health Bull. 50, 1912. Further evidence that the mites infecting rats may be responsible for transmitting this disease but no positive evidence that this is the case.

FOWLERTON, A. G. R. As to the nature of the parasites of leprosy and tuberculosis. Brit. Med. Jour. February 10, 1912, p. 300. Believes that the causative

agent is not a bacillus but a *Streptothrix* and called *S. lepræ*. (This belongs to a group placed by Hiss & Zinsser among the "higher bacteria." It has branching threads or mycelia and produces spores, hence, it would seem, is more liable to be transmitted by insects than if it were a true bacillus.)

LONG, EDWARD C. A note on the transmission of leprosy. Jour. Trop. Med. & Hyg. March 1, 1912, from Med. Rep. fr. Basutoland, 1910. Experiments seem to show that bedbugs biting leprous patients contain the *Bacillus lepræ* and that they may transmit them.

Our present knowledge of leprosy. Leading article in Brit. Med. Jour. June 29, 1912. Recent studies seem to show that causative organism may not be a bacillus as it has a more complicated life history. Many experiments seem to indicate that it may be transmitted by some insect such as house flies, biting flies, mosquitoes, fleas, lice, bugs, mites, ticks, and bedbugs being particularly suspected.

HOUSEFLY

BRITTON, W. E. The housefly as a disease carrier and how controlled. Pub. by Conn. Sta. Bd. of Health, 1912. Life history and habits. Methods of control.

BRITTON, W. E. The role of the housefly and certain other insects in the spread of human diseases. Pop. Sci. Mo., July, 1912. Tells how disease may be transmitted by insects and discusses flies, mosquitoes, fleas etc.

BRITTON, W. E. The housefly and its relation to typhoid fever. Proc. Sixth San. Conf. Hl. Of. of Conn. April, 1912, pp. 18. (Hartford.)

COX, G. LISSANT, LEWIS, F. C. AND GLYNN, E. E. The number and varieties of bacteria carried by the common housefly in sanitary and insanitary city areas. Jour. Hyg. Vol. 12, No. 3, October, 1912, pp. 290–312. Finds that the flies in insanitary areas contain many more bacteria, 800,000 to 500,000,000 per fly. Methods used in making the experiments, a review of previous experiments and a list of references are given.

GRAHAM-SMITH, G. S. Houseflies. Bedrock, No. 2, July 1912, pp. 205–223. Refers to the time when bedbugs were very common pests in many places and suggests that our descendants may look with as much surprise upon our tolerance of flies. Interesting notes on the methods of feeding and infection experiments. Shows that various bacteria including disease-producing germs may be found on the body and in the intestine from two to ten days or more.

HEWITT, C. GORDON. Observations on the range of flight of flies. Rep. Local Gvt. Bd. Pub. Health & Med. Sub. 1912 (n. s. No. 66), pp. 1–14. Experiments to show how far flies may fly from their breeding grounds. Seven hundred yards was the greatest range in these experiments.

HODGE, C. F. A new fly trap. Jour. Econ. Ent. Vol. 6, No. 1, February, 1913. pp. 110–112. Description of a large trap that has proved successful.

LUMSDEN, L. L. The causation and prevention of typhoid fever. Pub. Health. & Mar. Hos. Ser. Bul. 51, 1912. Discusses among other sources of danger the insanitary privies.

NICHOLLS, LUCIUS. Transmission of pathogenic micro-organisms by flies in Saint Lucia. Bul. Ent. Res. Vol. III, pt. 1, May, 1912, pp. 81–88. Experiments with flies breeding in human excrement, how some of them may carry germs from man to man directly or through his food.

PAINE, J. H. The housefly in its relation to city garbage. Psyche, Vol. XIX, No. 5, October, 1912, pp. 156–159. More than 22 per cent of the swarms of flies that breed in garbage cans are house flies.

RICHARDSON, C. H. An undescribed hymenopterous parasite of the housefly.

Psyche, Vol. XX, No. 1, February, 1913, pp. 38–40. Description and notes on a parasite reared from housefly pupæ.

STALLMAN, G. P. Ants destroying larvæ of flies. Mil. Surg. 31, No. 3, September, 1912.

TEBBUTT, HAMILTON. On the influence of the metamorphosis of *Musca domestica* upon bacteria administered in the larva stage. Jour. Hyg. Vol. 12, No. 4, December, 1912. pp. 516–526. Concludes that "The possibility of flies becoming infected from the presence of pathogenic organisms in the breeding ground of the larvæ may be considered as very remote."

TERRY, C. E. Extermination of the housefly in cities, its necessity and possibility. Amer. Jour. Pub. Health, Vol. II, January, 1912, pp. 14–22. Danger in cities without good sewage systems. Ground floors of stable stalls often worst breeding places, sometimes two or more inches deep. Eggs and larvæ under 14, 26, 36, 41 and 48 inches sterilized sand produced flies which harbored bacteria with which the food of the larvæ was infected.

THOMPSON, F. W. Housefly as carrier of typhoid infection. Jour. Trop. Med. & Hyg. XV, No. 18, September 16, 1912.

TORREY, JNO. C. Bacteria and flies. Jour. Infec. Dis. March, 1912. The fly as an agent in the spread of disease. Four hundred and seventy to 4,400,000 organisms on surface of fly, 16,000 to 28,000,000 organisms in intestine. Some of these were fecal bacteria of the colon type; 13.1 per cent on the surface, 37.5 per cent in the intestine.

TORREY, J. C. Numbers and types of bacteria carried by city flies. Jour. Infec. Dis., 10 (1912), No. 2, pp. 166–177. Record of numbers and kinds of bacteria found.

WASHBURN, F. L. The Minnesota fly trap. Circ. No. 24, August 12, 1912, State Ento. Minn. Description of this trap in which bread and milk was used for bait. (See also Jour. Eco. Ento. V, October, 1912, and Sci. N. S. 36, October 18, 1912.)

How to make a flyless town. World's Work, 24: June, 1912, pp. 176–179. Things necessary in a successful fly campaign.

The fly and the surface privy. Comment in Cal. Sta. Bd. Health. Vol. 7, May 1912, pp. 228–229. The danger from this source.

Transmission of *Trypanosoma hippicum* by the housefly. Rep. Dept. Sanit. Isthmian Canal Com. 1912, April, p. 41.

MYIASIS

AUSTEN, ERNEST E. British flies which cause myiasis in man. Rept. Loc. Gov., Bd. Pub. Health & Med. Sub. (n. s. No. 66) 1912, pp. 5–14. Notes on ten or more species. Bibliography.

BUSCK, A. On the rearing of a *Dermatobia hominis*. Proc. Ent. Soc. Wash. 14 (1912) No. 1, pp. 9–13. Records the breeding of this fly in human host.

COCKAYNE, Intestinal myiasis. Lancet, January 20, 1912. Larvæ of *M. domestica* and *Fannia* (*Homalomyia*) *canicularis* found in bed where child slept.

HEWITT, C. G. *Fannia* (*Homalomyia*) *canicularis* and *F. scalaris*. Paras. 5 (1912) No. 3, pp. 161–174. Bionomics of these flies and their relation to myiasis.

HEWITT, C. GORDON. An account of the bionomics and the larvæ of the flies *Fannia* (*Homalomyia*) *canicularis* L. and *F. scalaris* Fab. and their relation to myiasis of the intestinal and urinary tracts. Rep. Loc. Gvt. Bd. Pub. Health & Med. Sub. (n. s. No. 66) 1912, pp. 15–22, same in Parasit. V, No. 3, September, 1912. Gives reason for change of generic name. Descriptions of the stages of the two species and

notes on their habits. Often found in alimentary canal and sometimes in urinary tract. References to literature.

KNAB, FREDERICK. The habits of flies of the genus *Cordylobia*, parasitic on man in Africa. Sci. N. S. XXXV, April 26, 1912. p. 662 Review of an article by Roubaud in Compt. Rendus Hebdom. des Seances de l'Acad. des Sci. October 23, 1911. The larvæ of *C. anthropophaga* found under skin of man and domestic animals, larvæ hatch in sand or elsewhere and later penetrate their host. Natives who sleep on the ground more apt to be infected. Another observation by von Pelser-Berensberg (Soc. Entomol. Vol. 26, p. 34, July 29, 1911) on *C. rodhaini* showed that these flies laid their eggs on his underclothing while he was bathing. The larvæ hatched and penetrated the skin.

SINGLETON. *Dermatobia noxialis* infection in man. Jour. Amer. Med. Assn. April 27, 1912. A larva called *ver macaque* occurring under skin of a man.

PELLAGRA

FORBES, STEPHEN A. On black flies and buffalo-gnats (*Simulium*) as possible carriers of pellagra in Illinois. 27th. Rep. Sta. Entom. of Ill., pp. 21–52. (1912.) Habits and life history of the group; description of Illinois species. possible relation to pellagra; no definite data.

GARMAN, H. A preliminary study of Kentucky localities in which pellagra is prevalent. Kentucky Agric. Ex. Sta. Bull. 159, January, 1912. The following facts were observed which indicate that the disease might be insect-borne; eruptions in the cases noted, first appeared on the hands, arms, neck or legs, portions of the body exposed to insect bites. The disease becomes most prevalent just after Simulium appear in greatest numbers. It often attacks children who go bare-footed and bare-legged and who wash in streams. List of insects and other animals studied. A summary of Dr. Sambon's findings.

HUNTER, S. J. Sand-fly and pellagra. Jour. Amer. Med. Assn. LVIII, February 24, 1912. Discusses theories as to cause, particularly Sambon's theory and records experiments, not yet completed, to test this theory.

HUNTER, S. J. Pellagra and the sand-fly, II. Jour. Econ. Ent. Vol. 6 No. 1, February, 1913, pp. 96–101. Notes on the distribution and life history of these flies in Kansas. Investigators have not been able to inoculate monkeys with this disease. Some of their findings seem to favor Sambon's theory, but anything like definite proof is still lacking.

LAVINDER, C. H. A report of the second triennial meeting for the study of pellagra, held at Columbia, S. C. October 3–4, 1912. Pub. Health Rpts. Vol. 27, No. 44, November 1, 1912, pp. 1776–1778. Notes on papers presented. In one of these Jennings and King suggested that Stomoxys may possibly act as a carrier.

NICHOLLS, LUCIUS. Pellagra: "Sand-fly Protozoon" versus "maize "theory. Jour. Trop. Med. & Hyg. Vol. 15, No. 20, October 15, 1912. pp. 305–306. Author not an ardent supporter of either the maize or Sambon's theory of infection.

ORMSBY, OLIVER S. (Med. Secty. Ill. Pellagra Comm.) Jour. Cutaneous Dis. Vol. 30, No. 10, October, 1912, pp. 589–607. Believe that the disease is due to infection with some living micro-organism, possibly in the alimentary canal of man. They found but little to support Sambon's theory.

RAVITCH, M. L. A plea for an earlier diagnosis of pellagra. Jour. Amer. Med. Assn. Vol. LIX, July, 6, 1912, pp. 33–35. Discusses causes and transmitting agents. Believes that corn theory is most plausible. Does not believe that Sambon's theory in regard to the sand-fly or that Garman's theory in regard to the buffalo-gnat can be proved.

ROBERTS, STEWART R. Pellagra,—history, distribution, diagnosis, prognosis, treatment, etiology. C. V. Mosby Co. St. Louis, 1912.

Literature on pellagra and hookworm. Jour. Amer. Med. Assn. Vol 59, No. 13, September 28, 1912, p. 1205. A list of recent books and papers on these subjects.

PHLEBOTOMUS OR SAND-FLY FEVER

ROBINSON, S. C. B. AND BLACKHAM, R. J. Sand-flies and sand-fly fever on the North-West frontier of India. Jour. Roy. Army Med. Corps, Vol. 19, No. 14, October, 1912, pp. 447–452. Includes notes on *Phlebotomus*; the flies are sometimes so numerous as to make evacuation of barracks necessary.

SEIDELIN, HARALD. Pappataci fever. Yel. Fev. Bur. Bul. Vol. II, No. 1, July, 1912, pp. 74–84. A full discussion of this disease and the fly (*Phlebotomus pappataci*) which transmits it.

Pappataci fever. An. Rep. San. Com. with Gov. India, 1910–12, pp. 59 and 25. Includes an account of life history of *Phlebotomus*.

POLIOMYELITIS

ANDERSON, JOHN F. Transmission of poliomyelitis by means of the stable fly (*Stomoxys calcitrans*). Pub. Health Rep. Vol. 27, No. 43, October 25, 1912, pp. 1733–1735. Stomoxys allowed to bite infected monkeys and then transferred to uninfected monkeys which later died of the disease. These experiments confirm those made by Rosenau.

BISHOPP, F. C. The stable fly (*Stomoxys calcitrans*) an important livestock pest. Jour. Econ. Ent. Vol. 6, No. 1, February 19, 1913, pp. 112–126. Importance of the pest, life history and habits, and methods of control.

BOUET, G. & ROUBAUD, E. Expériences de Transmission des Trypanosomiasis animales de l'Afrique Occidentale française, par les Stomoxes. Bul. de la Soc. Path. Exot. Jouillet V. No. 7, 1912, pp. 544–550. It is demonstrated that certain trypanosomes, particularly those of surra, are transmitted by *Stomoxys*.

BRAIN, C. K. *Stomoxys calcitrans* Linn. Annals Ento. Soc. Amer. Vol. 5, No. 4, December, 1912. pp. 421–430. Compares *M. domestica*, *H. canicularis*, and *S. calcitrans* and gives notes on structure and feeding habits of the latter.

BRUES, C. T. AND SHEPPARD, P. A. E. The possible etiological relation of certain biting insects to the spread of infantile paralysis. Jour. Econ. Ento. Vol. 5, August, 1912, pp. 305–324. Data which suggests that insects may be the carriers. Table of diseases that are insect-borne, record of investigations.

FLEXNER, S. Infantile paralysis: Problems in infection and its control. Sci. n. s. 36, November 22, 1912, pp. 685–702. A discussion of the progress made in the study of this disease.

FROST, WADE H. Notes on the discussion of poliomyelitis at the fifteenth international Congress of Hygiene and Demography. Pub. Health Rpts. Vol. 27, No. 41, October 11, 1912, pp. 1661–1664. Includes brief review of Rosenau's findings.

HOWARD, C. W. AND CLARK, P. F. Experiments on insect transmission of the virus of poliomyelitis. Jour. Exp. Med. Lancaster, Pa. 16, No. 6, December, 1912.

RICHARDSON, MARK W. Recent contributions to our knowledge concerning infantile paralysis. Amer. Jour. Pub. Health, Vol. 2, No. 3, 1912, pp. 141–144. Review of some recent observations and experiments.

ROSENAU, M. J. AND BRUES, C. T. Some experimental observations upon monkeys concerning the transmission of poliomyelitis through the agency of *Stomoxys calcitrans*, a preliminary note. Psyche, Vol. XIX, No. 6, December 1912, pp. 191–194. Gives reasons for suspecting these flies and records the experiments by which

they apparently transmitted the virus of poliomyelitis from monkey to monkey. (See also Jour. Amer. Med. Assn. October 12, 1912, November 2, 1912, Pub. Health Rpts. September 27, 1912 and several places for comment and reviews of the experiments.

Poliomyelitis (infantile paralysis). Pub. Health Rpts. Vol. 27, No. 35, August 30, 1912, pp. 1412–1413. A summary of the outbreaks in United States during the past few months.

Poliomyelitis. Bulletin for information of health officials. Cal. St. Bd. of Health October 15, 1912. Summaries of the theories in regard to this disease and suggests measures for control.

Other Flies

Cleland, J. B. Memorandum on surra. Sec. Rep. Gov. Bur. Microbiol. N. S. Wales, September, 1912, pp. 71–72. Notes the presence of *Stomoxys calcitrans* which is regarded as the transmitter of surra.

Cragg, F. W. Studies on the mouthparts and sucking apparatus of the blood-sucking Diptera, (No. 1 *Philæmatomyia insignis*). Sci. Mem. Govt. India, No. 54, 1912. Structure of the mouth parts of this fly which is closely related to *Musca*.

Cragg, F. W. The structure of *Hæmetopota pluvialis*. Sci. Mem. Govt. India, No. 55, 1912. A good discussion of the external and internal anatomy of this Tabanid.

Knab, Frederick. Blood-sucking and supposedly blood-sucking Leptidæ. Proc. Ent. Soc. of Wash. Vol. 14, No. 2, April–June, 1912, pp. 108–110. Some species of Leptidæ that bite man and animals. Discussion of other species.

Knab, F. and Cooley, R. A. Symphoromyia as a blood-sucker. Proc. Ent. Soc. Wash. 14, 3, September, 1912, p. 161. Notes on this Leptid which Professor Cooley found biting in Montana.

Leese, A. S. Biting flies and surra. Jour. Trop. Vet. Sci. 1912, January 7, No. 1, pp. 19–32. Believes that mechanical transmission is the usual way in which these flies transmit this disease. *Lyperosia*, *Stomoxys* and *Tabanidæ* may be concerned.

Trypanosomes, Tsetse Flies and Sleeping Sickness

Blacklock, B. The vitality of and changes undergone by Trypanosomes in the cadaver of the animal host. Ann. Trop. Med. & Par. VI. No. 1 B. May, 1912, pp. 55–68. (Abs. in S.S. Bull. 38, p. 125.) *T. gambiense* and *T. rhodesiense* can remain infective in the blood of a dead animal host for 48 hours.

Carpenter, G. D. H. Progress report on investigations into the bionomics of *Glossina palpalis*, July 27, 1910 to August 5, 1911. Rep. of Sl. Sickn. Com. of Roy. Soc. No. 12, 1912, pp. 79–111.

Darling, S. T. Experimental infection of the mule with *Trypanosoma hippicum* by means of *Musca domestica*. Jour. Exp. Med., 15 (1912), No. 4, pp. 365–366.

Duke, H. L. Antelope and their relation to Trypanosomiasis. Proc. Roy. Soc. ser. B. Vol. 85, May, 1912, pp. 156–169. (No. B 577.) Antelope act as reservoirs for *T. gambiense*.

Fell, T. E. Notes on tsetse flies and on prophylactic measures against sleeping sickness in the western province of Ashanti. Bull. Ent. Res. Vol. 3, pt. 3, November, 1912, pp. 227–231.

Fraser, A. D. and Duke, H. L. The relation of wild animals to Trypanosomiasis. Proc. Roy. Soc. March, 1912, B. 85 No. B 576. *T. uniformæ* was the only trypanosome obtained from wild animals as a result of this study.

Jack, Rupert W. Observations on the breeding haunts of *Glossina morsitans*. Bul. Ent. Res. Vol. II, pt. 4, January, 1912, pp. 357–361. Records finding of pupæ.

KINGHORN, ALLAN. Notes on the preliminary stages of *Glossina morsitans* Westw. Bul. Ent. Res. Vol. 2, pt. 4, January, 1912, pp. 291–296. Description of larva and pupa.

KINGHORN, ALLAN AND YORKE, WARRINGTON. On the transmission of human trypanosomes by *Glossina morsitans* Westw.; and on the occurrence of human trypanosomes in game. Amer. Trop. Med. & Par. 1912, March 2, No. 1, A. pp. 1–23. Conclude that the human trypanosomes in some regions are transmitted by *G. morsitans*. They may become infective 14 days after feeding on infected animals; they remain infective for life. Mechanical transmission does not occur after a period of 24 hours. Some of the native wild and domesticated animals have been found infected with the same trypanosome.

KINGHORN, ALLAN AND YORKE, WARRINGTON. A further report on the transmission of human trypanosomes by *Glossina morsitans* Westw. Ann. Trop. Med. & Par. 1912, July 31, 6, No. 2, pp. 269–285. Confirms their earlier observations.

KINGHORN, ALLAN AND YORKE, WARRINGTON. On the influence of meteorological conditions on the development of *Trypanosoma rhodesiense* in *Glossina morsitans*. Brit. Med. Jour. October 5, 1912, pp. 835–837; Ann. Trop. Med. & Par. October 18, 1912, Vol. 6, No. 3, B. pp. 405–413. High temperatures most favorable.

KINGHORN, ALLAN, YORKE, W., AND LLOYD, L. On the development of *Trypanosoma rhodesiense* in *Glossina morsitans*. Ann. Trop. Med. & Par. Vol. 6, No. 4, December 30, 1912, pp. 495–503. The trypanosome was found in the salivary glands of all flies capable of infecting animals.

KLEINE, F. K. The identity and mode of transmission of trypanosomes. Brit. Med. Jour. November 2, 1912, pp. 1183–1185.

LAFONT, A. Note on a Trypanosome from *Conorhinus rubrofasciatus* and its inoculation into the rat and mouse. Compt. Rend. Soc. Biol. (Paris), 72 (1912), No. 9, pp. 380–382, abs. in Sl. Sickn. Bur. (London), Bul. 4 (1912), No. 36, pp. 140–141.

LOW, G. C. Progress in sleeping sickness investigations in Nyassaland and Northeastern Rhodesia. Jour. Trop. Med. & Hyg. Vol. 15, January 15, 1912, pp. 26–27. Discusses the probable results of the recent investigations which show that *G. morsitans* carries *T. rhodesiense* which may prove to be the same as *T. gambiense*.

MACFIE, J. W. SCOTT. Tsetse flies and their bionomics. Bull. Ent. Res. iii, pt. I, May, 1912, pp. 61–72; abs. S. S. Bur. 38, p. 231. The dissemination of the number of tsetse flies in northern Nigeria during the dry season is due to the dryness of the atmosphere and the burnt-up condition of the country.

MESNIL F. *Trypanosoma rhodesiense* and *Trypanosoma gambiense*. Brit. Med. Jour. November 2, 1912, pp. 1185–1186. Compares the two species.

NUTTALL, G. H. F. Trypanosomiasis. Parasit. 5, No. 4, January, 1913. One of the Hector lectures. Particular attention paid to the forms transmitted by Arthropods.

ROBERTSON, MURIEL. Notes on certain aspects of the *Trypanosoma gambiense* in *Glossina palpalis*. Proc. Roy. Soc. Ser. B, 85, No. B. 578, pp. 241–248. Experiments concerned with the proportion of flies in which the trypanosomes will develop.

ROBERTSON, MURIEL. Notes on the life history of *Trypanosoma gambiense*. Abs. Proc. Roy. Soc. 1912, December 17, Ser. B. Vol. 86, No. B 584, pp. 66–71. A brief synopsis of experiments.

STEPHENS, J. W. W. AND FANTHAM, H. B. *Trypanosoma rhodesiense* (Stephens & Fantham) a second species of African trypanosome producing sleeping sickness in man. Brit. Med. Jour. November 2, 1912, pp. 1182–1183. Reasons for regarding this as a distinct species.

The sleeping sickness reservoir. Comment in Brit. Med. Jour. April 27, 1912, p.

969, June 22, 1912, p. 1445. Refers to work of Kinghorn and Yorke which showed that the wild game of Northern Rhodesia harbored *T. rhodesiense* which is closely related to *T. gambiense*, possible only a strain of the latter. It is carried by *G. morsitans*. Discusses the possibility of destroying the game or the flies, both of which seem impracticable but which as yet are the most feasible things suggested for making the infected regions safe.

Reports of the sleeping sickness Commission of the Royal Society. No. 12, 1912, H. M. Stationery Office. Sixteen articles on the results of work of this commission.

The transmission of trypanosomes. Slp. Sick. Bull., No. 35, March 7, 1912, pp. 117–118. Considerable evidence which indicates that they may be transmitted by *Tabanus*, *Hæmatopota*, *Stomoxys*, *Pangonia* and *Lyperosia*.

Rats, Squirrels, Fleas, Plague

Blue, Rupert. Anti-rat ordinances of San Francisco, Cal. Pub. Health Rpts. Vol. 27, No. 33, August 16, 1912, pp. 1319–1329. Texts of various ordinances.

Braddock, C. S. (Jr.). Bubonic plague seen at close range in the far East. Some random notes. N. Y. Med. Jour. Vol. 96, No. 9, August 31, 1912, pp. 419–420. Infected rat fleas passed to dogs and thence to children causing many deaths.

Von Ezdorf, R. H. The occurrence of plague in Habana and the measures adopted for its control and eradication. U. S. Pub. Health Rep. Vol. 27, No. 42, October 18, 1912, pp. 1697–1702. A slight outbreak of plague between July and September, 1912, was controlled by strict quarantine and a well organised fight against rats.

Fox, C. Some common Siphonaptera of Philippine Islands. Phil. Jour. Sci. 7, No. 2, April, 1912.

Guiteras, Juan. Three cases of bubonic plague in Havana. Jour. Amer. Med. Assn. Vol. 59, No. 20, November 16, 1912, pp. 1780–1784. Points out the advantage of letting the public know the true condition of affairs, then their help can be depended upon.

King, Howard D. Plague—the menace of the United States of America. Jour. Amer. Med. Assn. Vol. 59, July 17, 1912, pp. 237–242. Points out the present danger and the part that rats and other rodents might take in the introduction of plague from some of our southern neighbors.

Long, Jno. D. A squirrel destructor. An efficient and economical method of destroying ground squirrels. U. S. Pub. Health Rep. Vol. 27, No. 39, September 27, 1912, pp. 1594–1596. Carbon bisulphide vapor is pumped into the hole by a specially devised pump.

McCoy, Geo. W. and Chapin, Chas. W. Studies of plague, a plague-like disease, and tuberculosis among rodents in California. Pub. Health Bul. No. 53, January, 1912, pp. 1–25. Six papers dealing with these subjects are brought together in this bulletin.

McCoy, Geo. W. Notes on the bionomics of rats and ground squirrels. Pub. Health Rpts. Vol. 27, No. 27, July 5, 1912, pp. 1068–1072. Breeding and feeding in captivity.

McCoy, G. W. and Chapin, C. W. Further observations on a plague-like disease of rodents with a preliminary note on the causative agent, *Bacterium tularense*. Jour. Infec. Dis. 10, No. 1, January, 1912. Have demonstrated that fleas may transmit the disease among squirrels.

Nicoll, William. On the length of life of rat flea apart from its host. Brit. Med. Jour. October 12–26, 1912, pp. 926–928, 1097–1098. Average length of life of *C.*

fasciatus apart from its host is under 7 days. Larval and pupal stages may be prolonged for several months under certain conditions.

PREBLE, PAUL. The tarbagan (*Arctomys bobac*) and plague. Pub. Health Rep. Vol. 27, No. 2, January 12, 1912, pp. 31–39. Notes on the habits and diseases of this animal and its possible relation to plague in humans.

RODIER, ———. The rat problem. Letter in Jour. Trop. Med. & Hyg. Vol. 15, July 1, 1912, pp. 205–207. Discusses the Rodier method of rat extermination which is as follows: catch as many rats as possible alive, kill the females, turn males loose alive. After awhile the males will become more numerous than the females and by worrying the females and killing the young they will destroy all that is left and then die of old age. As long as the rats are polygamous they will increase, but they will decrease when they become polyandrous.

RUCKER, WM. COLBY. The eradiction and prevention of bubonic plague. Pub. Health Rpts. Vol. 27, No. 29, July 19, 1912, pp. 1130–1142. A good summing up of the preventive and protective measures.

RUCKER, W. C. The necessity of rodent extermination in American seaports. Jour. Amer. Med. Assn. Vol. 59, July 27, 1912, pp. 243–244. Danger from these pests and methods of exterminating them, trapping, ratproofing of buildings; cutting off food supply; poisoning.

RUCKER, W. C. How to poison rats. U. S. Pub. Health Rep. Vol. 27, No. 32, August 9, 1912, pp. 1267–1268. A glucose paste containing 4 per cent phosphorous is spread on all sides of small pieces of stale bread and placed in rat holes.

SARGENT, E. AND E., L'HERITIER, A. AND LEMAIRE, G. Transmission of Leishmania from dog to dog by *Pulex serraticeps*. Bul. Soc. Path. Exot. No. 5 (1912), No. 8, pp. 595–597. Experiments gave positive results.

STRONG, R. P. AND TEAGUE, O. Susceptibility of animals to pneumonic plague. Phil. Jour. Sci. Sec. B. (Phil. Jour. Trop. Med.) Vol. 7, No. 3, June, 1912, pp. 223–228. Marmots and tarbagans inoculated with pneumonic strain of plague develop the bubonic type. The latter harbors a flea which bites man.

STRONG, R. P. Studies on pneumonic plague immunization. I. Introduction. The expedition to Manchuria and the conditions under which the work was performed there. Phil. Jour. Sci. Sec. B. (Phil. Jour. Trop. Med.) Vol. 7, No. 3, June, 1912, pp. 131–136.

SWELLENGREBEL, N. H. Contribution to the knowledge of the biology of European rat fleas (*Ceratophyllus fasciatus*). Arch. Schiffs. u. Tropen. Hyg., 16 (1912), No. 6, pp. 169–182. Distribution in Amsterdam, feeding experiments, etc.

TIDSWELL, FRANK. Researches on plague. Second Rep. Gov. Bur. Microbiol. N. S. Wales, September, 1912, pp. 39–43. Includes list of ectoparasites collected from rodents, notes on fleas, etc.

DE VOGEL, W. T. The connection between man and rat in the plague epidemic in Melang, Java, in 1911. Far East Assn. Trop. Med.; Trans. 2nd Bien. Cong. held at Hongkong, 1912, pp. 147–149.

WARREN, E. W. The relation of the rat to the public health. South. Med. Jour. Vol. 5, No. 7, August, 1912, pp. 500–502.

Sixth report on plague investigations in India. Issued by the advisory committee Jour. Hyg. & Plague, Sup. 1. (Vol. 11, December, 1911), pub. 1912, 206 pp. Among other articles some of which deal with the method or spread of the disease is an "Epitome of some recent observations on rat fleas."

Report of the international plague conference held at Mukden, 1911. Man. Bur. of Printing, 1912, 483 pp.

Plague and its relation to maritime quarantine. Pub. Health Rpts. Vol. 27, No.

50, December 13, 1912, pp. 2074–2076. Tells of the campaigns of education in regard to this subject.

March of the black death to the United States. Cur. Lit. 53; October 1912, pp. 426–428. How the plague is being fought.

The steady advance of the plague. Editorial Jour. Amer. Med. Assn., Vol. 59, July 27, 1912, pp. 278–279. Plague now in Trinidad, Porto Rico and Cuba. Danger from Pacific Coast. Need of the public being thoroughly awake to the dangers.

The plague situation. Editorial Jour. Amer. Med. Assn. August 3, 1912, Vol. 59, No. 5, pp. 374–375. Review of present pandemic beginning in 1894. Now encircles the globe. Cuba last to be infected. Danger of it appearing in the southern United States.

The plague situation. Pub. Health Rpt. Vol. 27, No. 36, September 6, 1912, p. 1463. Names places where plague exists at present.

The plague situation. Pub. Health Rpts. Vol. 27, No. 35, August 30, 1912, pp. 1409–1410. Restrictions on passenger traffic from Cuba waived because of no plague cases since July 27.

The rat as a source of economic and health waste. Jour. Amer. Med. Assn. V. 59, No. 7, August 17, 1912, p. 518. Points out the great waste caused by rats and the danger in allowing them to multiply. Suggests that individual property owners be made to keep their premises free.

Rat extermination a public duty. Editorial Jour. Amer. Med. Assn. Vol. LIX, July 27, 1912, pp. 279–280. The need for action in face of the present danger.

Anti-rat ordinance of Seattle, Washington. Pub. Health Rpts. Vol. 27, No. 34, August 23, 1912, pp. 1373–1374. Text of ordinance.

Anti-rat ordinance of Oakland, Cal. Pub. Health Rpts. Vol. 27, No. 34 August 23, 1912, pp. 1371–1373. Text of ordinance.

Spotted Fever

Birdseye, C. Some common mammals of Western Montana in relation to agriculture and spotted fever. Farm. Bull. 484, March, 1912. Notes on species and habits and methods of destroying: relation to the fever.

Birdseye Clarence. Rocky Mountain spotted fever, rodents and ticks. Note in Amer. Jour. Pub. Health 1912, II, No. 3, p. 219. Refers to Farmers Bull. 484 U. S. Dept. Agric.

McClintic, Thos. B. Investigations of, and tick eradication in Rocky Mountain spotted fever. Pub. Health Rep. Vol. 27, No. 20, May 17, 1912, pp. 732–756. A detailed record of field and laboratory investigations. Dipping domestic stock, destruction of wild mammals and the clearing and burning over of land are recommended.

Reed, A. C. Spotted fever. Hero of peace. Outlook, 102; September 28, 1912, pp. 178–179. Notes on spotted fever and the life of Dr. T. B. McClintic who died of the fever contracted while studying it.

Rucker, W. C. Rocky Mountain spotted fever. Pub. Health & Mar. Hos. Serv. U. S., Pub. Health Rpts. 27 (1912), No. 36, pp. 1465–1482. A summarized account; bibliography.

Another martyr to scientific medicine. Jour. Amer. Med. Assn. 59, No. 7. August 17, 1912, p. 550. Dr. T. B. McClintic of the U. S. Pub. Health Serv. died in Washington August 13, 1912, of Rocky Mountain spotted fever contracted while investigating the disease in Montana. He was regarded as the leading authority on this disease.

Ticks and Various Diseases

Bishopp, F. C. The fowl tick (*Argas miniatus* Koch). U. S. Bur. Ent. Circ. 170, March 31, 1913. Distribution, life history, control.

Bishopp, F. C. A new species of Dermacentor and notes on other North American Ixodidæ. Proc. Biol. Soc. Wash. 25 (1912), pp. 29–37. *D. hunteri* taken on mountain sheep.

Christophers, S. R. The development of *Leucocytozoon canis* in the tick with a reference to the development of Piroplasma. Parasit. 5 No. 1. February, 1912.

Dalrymple, W. H. Anthrax and tick fever. Amer. Vet. Rev. 40 (1912 , No. 5. pp. 601–610. The housefly and the ant and probably other insects often coming in contact with anthrax flesh may become dangerous carriers of the infection.

Dalrymple, W. H. Anthrax and tick fever. Amer. Vet. Rev. 40 (1912), No. 6, pp. 757–764. Deals with Texas fever, the cattle tick and its eradication.

Graybill, H. W. Studies on the biology of the Texas fever tick. Bul. 152, U. S. Dep. Agric., 1912. 13 pp.

Graybill, H. W. Methods of exterminating the Texas fever tick. U. S. Dept. Agr. Farmers Bul. 498, 1912, 42 pp. Life history and methods of control by dipping and pasture rotation.

Hindle, E. Attempts to transmit "fowl pest" by *Argas persicus*. Bul. Soc. Path. Exot., 5 (1912), No. 3, pp. 165–167. Results negative.

Hindle, E. and Merriman, G. The sensory perception of *Argas persicus*. Parasit. 5, No. 3, September, 1912. An interesting series of experiments. "Haller's organ" regarded as olfactory.

Hooker, W. A., Bishopp, F. C. and Wood, H. P. The life history and bionomics of some North American ticks. U. S. Dept. Agric. Bur. Ent. Bul. 106, p. 239. General bionomics of the group and life history of several species.

Jennings, Allan H. Some notes on the tick *Ornithodorus talaje* Guerin. Proc. Ent. Soc. of Wash. Vol. 14, No. 2, April–June, 1912, pp. 77–78. Records this species from rats in Canal Zone.

Moore, Wm. The tick problem in South Africa. Jour. Econ. Ent. Vol. 5, 1912, No. 5, pp. 377–384. List of ticks known to transmit diseases and other ticks that attack animals in South Africa. Notes on life history of some of the species. Control methods.

Nuttall, G. H. F. Notes on ticks: II, New species (*Amblyomma, Hæmaphysalis*); *Ixodes putus:* Description of the hitherto unknown larval stage. Par. 5 (1912), No. 1, pp. 50–60. Three new species described.

Ransom, B. H. Eradication of the Southern cattle tick. Proc. 7th Inter. Zoöl. Cong., pp. 648, 655. (Paper read August, 1907, pub. 1912.) Loss estimated at $40,000,000 annually. Methods of control. Rotation of pastures most efficient.

Ransom, B. H. and Graybill, H. W. Investigations relative to arsenical dips as remedies for cattle ticks. U. S. Dept. Agric. Bur. Anim. Indus. Bul. 144, pp. 65.

Theiler, A. The transmission of gall-sickness by ticks. Agr. Jour. Union So. Africa, 3 (1912), No. 2, pp. 173–181.

Warburton, C. Notes on the genus *Rhipicephalus*, with the description of new species, and the consideration of some species hitherto described. Parasit. 5, No. 1, February, 1912.

Spirocheta

Bayou, H. The experimental transmission of the spirochæte of European relapsing fever to rats and mice. Parasit. 5, No. 2, June, 1912. Believes that in Moscow, relapsing fever is commonly transmitted by *Pediculus vestimenti* and not by *Cimex*.

HINDLE, E. The inheritance of spirochetal infecton in *Argas persicus*. Proc. Cambridge Phil. Soc. 16 (1912), No. 6, pp. 457–459. A tick once infected transmits the infection to its offspring of the first and second generation.

NUTTALL, G. H. F. Spirochætosis. Parasit. 5, No. 4, January, 1913. One of the Herter lectures. Deals particularly with those diseases that are transmitted by ticks, lice, bedbugs. Also gives important notes on the life history of the body louse.

ROSS, PARK. Human spirochætosis. Transv. Med. Jour. Vol. 7, No. 7, February, 1912. Review of work done on the disease. Some of the natives fear the tick *Ornithodorus* and will not sleep in infested huts.

DOBELL, CLIFFORD. On the systematic position of the Spirochætes. Proc. Roy. Soc. ser. B, Vol. 85, No. B 578, June 14, 1912, pp. 186–191. Classification must be based on morphological evidence. Believes that they are more closely related to the Bacteria than to Protozoa or *Cyanophyceæ*.

BEDBUGS AND VARIOUS DISEASES

FANTHEM, H. B. Some insect flagellates and the problem of the transmission of Leishmania. Brit. Med. Jour. November 2, 1912. pp. 1196–1197.

GIRAULT, A. A. Preliminary studies on the biology of the bedbug, *Cimex lectularius*. II Facts obtained concerning the duration of its different stages. Jour. Eco. Biol. 7, No. 4, December, 1912. Under favorable conditions the bug breeds continuously throughout the year, but there may be at least three or four generations. Gives duration of life of different stages under various conditions.

MANNING, J. V. A contribut on to the study of the possible agency of the bedbug, *Cimex lectularius*, in transmission of acute poliomyelitis from man to man. Med. Times, vol. 60, April, 1912. Shows that the bedbug fullfils the necessary requirements as a carrier of this disease.

MANNING, J. V. Bedbugs and bubonic plague. Med. Rec. Vol. 82, No. 4, July 27, 1912, pp. 148–150. Refers to Vubitski's experiments and gives notes on habits and control.

OLSEN, C. E. On the endurance of swarms of *Cimex lectularius* L (Hemip). Bul. Brooklyn Ent. Soc. Vol. 8, December, 1912, pp. 24–25. Specimens kept alive in bottles two or three months.

PATTON, W. S. Kala-Azar problem. Brit. Med. Jour. 2, No. 2705, November 2, 1912.

PATTON, W. S. Preliminary report on an investigation into the etiology of oriental sore in Cambay. Sci. Mem. by Offi. of Med. & San. Dept. of Govt. India, n. s., No. 50, 1912. Believes that the bedbug is the transmitter of this disease.

PATTON, W. S. The development of the parasite of Indian Kala-Azar (*Herpetomonas donovani* Laveran & Mesnil) in *Cimex rotundatus* Sign. and in *Cimex lectularius* Linn. with some observations on the behavior of the parasite in *Conorrhinus rubrofasciatus* de Geer. Sci. Mem. by Offi. of Med. San. Dept. Govt. India, 1912, (n. s.), No. 53, p. 38.

RIGGS, R. E. Bedbug as carrier of typhoid. Mil. Surg. XXXI, No. 3, September, 1912.

RUCKER, W. C. The bedbug. Pub. Health Rpts. Vol. 27, No. 46, November 15, 1912, pp. 1854–1856. Notes on habits and control.

WENYON, C. M. Experiments on the behavior of Leishmania and allied flagellates in bugs and fleas, with some remarks on previous work. Jour. Lon. Sch. Trop. Med. Vol. 2, pt. 1, December, 1912, pp. 13–26.

Etiology of Kala-azar. Nature 89, June 13, 1912. pp. 386–388. Notes on a

lecture by W. S. Patton in which he discusses the relation of the parasite that causes the disease, to its hosts.

Kala-azar and the bedbug. Lancet (London), 1912, I, No. 8, p. 520. Discussion of recent investigations.

Sensational aspects of the bedbug peril. Cur. Lit. 53; October, 1912, pp. 420–421. Refers to the papers of Manning and others showing the possibility of this insect carrying disease.

Mode of propagation of infantile paralysis: the bedbug as a spreader of disease. Sci. Am. S 73, May 11, 1912. p. 229. Review of Dr. Manning's article in Medical Times in which he gives reasons for believing that the bedbug may spread this disease.

Typhus Fever

Anderson, John F. The relation of so-called Brill's disease to typhus fever' An experimental demonstration of their identity. Pub. Health Rep. 27, No. 5' February 2, 1912; also in Hyg. Lab. Bul. No. 86, October, 1912, pp. 25–35. Concludes that the two diseases heretofore considered as distinct are the same.

Anderson, John F. Studies on immunity and means of transmission of typhus. Hyg. Lab. Bul. 86, October, 1912, pp. 81–138. Experiments relating to the hereditary transmission of the virus in the body louse gave negative results. A few experiments relating to the transmission of this disease by bedbugs also gave negative results.

Anderson and Goldberger. Demonstration of the identity of the so-called Brill's disease with typhus. Pub. Health Rep. February 2, 1912, p. 149, Jour. Amer. Med. Assn. February 10, 1912, p. 414.

Birt, C. Typhus fever. Jour. Roy. Army Med. Corps. Vol. 19, No. 5, November, 1912, pp. 521–529. Summary of our present knowledge of this disease and the methods of transmission.

Goldberger, Jos. Studies on the virus of typhus. Duration of the infectivity of the blood. Hyg. Lab. Bul. No. 86. October, 1912, pp. 49–80. Reprinted from Pub. Health Rpts. 27, No. 22, May 31, 1912. Includes account of some experiments with the virus of the louse.

Goldberger, Jos. and Anderson, John F. The transmission of typhus fever, with especial reference to transmission by the head louse (*Pediculus capitis*). Pub. Health Rep. Vol. 27, No. 9, March 1, 1912, pp. 297–307. Review of our present knowledge in regard to the spread of the disease and record of experiments. Conclude that the virus may be transmitted by lice.

Goldberger, Jos. and Anderson, J. F. Some recent advances in our knowledge of typhus. Jour. Amer. Med. Assn. 5, 59, No. 7, August 17, 1912. pp. 514–517. Among other things they discuss the transmission of this disease by body lice and possibly by head lice and show that Brill's disease is the same as typhus, thus this problem is of direct interest to Americans.

Hewitt, C. Gordon. Transmission of typhus fever by lice. Can. Ent. XLIV 4, April, 1912, p. 103. Refers to Goldberger and Anderson's paper (Pub. Health Rep. March 1, 1912) in which they show that *P. capitis* as well as *P. vestimenti* may carry typhus fever and points out the importance of this.

Collected studies of typhus. Hyg. Lab. Bull. No. 86, October, 1912. A bringing together of a series of papers on this disease published in 1911–12. Those published in 1912 are listed above.

Typhus fever. Jour. Amer. Med. Assn. Vol. 59, No. 25, December 21, 1912, pp. 2258–2260. Editorial reviewing the recent work by various investigators of this subject.

Lice

Fantham, H. B. *Herpetomonas pediculi*, nov. spec. Parasitic in the alimentary tract of *Pediculus vestimenti*, the human body louse. Proc. Roy. Soc. ser. B. Vol. 84, February 14, 1912, pp. 505–517. (No. B 574.) also in Ann. Trop. Med. & Par. March 29, 1912. Attempts to introduce this parasite into vertebrates failed. It shows no connection with any vertebrate trypanosome.

Girault, A. A. Notes on *Pediculus vestimenti* Nitzsch, the body louse of man. Ent. News 23, No. 8, October, 1912. Notes on feeding habits of certain reared broods.

McCoy, G. W. and Clegg, M. T. A note on acid-fast bacilli in head lice. (*Pediculus capitis.*) Pub. Health & Mar. Hos. Serv. U. S. Pub. Health Rep. 27, 1912. No. 36, pp. 1464–1465. Lice that had fed on leprous patients showed organisms indistinguishable from the leprosy bacilli.

Nicolle, C. Blaizot, L. and Conseil, E. I. Etiologie de la Fièvre Récurrente. Son Mode de Transmission par le Pou. II. Conditions de Transmission de la Fièvre Récurrente, par le Pou. Compt. Rend. de l'Acad. Sci. Vol. 154, No. 24. June 10, 1912, pp. 1636–1638 and also Vol. 155, No. 9, August 26, 1912, pp. 481–484; also (i) in Arch. Inst. Pasteur Tunis, No. 3, 1912, pp. 110–112. Records the first actual experiments to show that the relapsing fever may be transmitted by body lice.

Typhus fever and the head louse. Note in Amer. Jour. Pub. Health, 1912, 2 No. 3, pp. 215–216. Believe that the fever may be transmitted by the bite of the insect.

Miscellaneous Articles

Banks, Nathan. The structure of certain dipterous larvæ with particular reference to those in human foods. Bur. Ent. Tech. Ser. No. 22, January 10, 1912. Gives a synopsis of such flies and note on the life history of many of them.

Blue, Rupert. The problem of the public health. Jour. Amer. Med. Assn. Vol. 59, No. 6, August 10, 1912, pp. 413–415. Refers to the gradual development of the various organizations to promote public health and shows the necessity of all working together.

Brues, C. T. Blood-sucking insects as carriers of human diseases. Proc. Ent. Soc. Wash. 14, No. 3, September, 1912, p. 180. Notes on Dr. Knab's article (same vol. p. 79–81) pointing out certain conditions that Knab seems to have overlooked.

Brues, C. T. Insects as agents in the spread of disease. Pop. Sci. Mon. December, 1912, pp. 537–550. A comprehensive review.

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Howard, C. W. Insects directly or indirectly injurious to man and animals

in Mozambique, East Africa. Bul. Ent. Res. Vol. 3, pt. 2, August, 1912, pp. 211–218. An annotated list.

HUNTER, W. D. American interest in medical entomology. Jour. Econ. Ent. Vol. 6, No. 1, February, 1913, pp. 27–39. Points out the importance of the work and the desirability of more entomologists devoting their time to it.

KNAB, FREDERICK. Blood-sucking insects as transmitters of human disease. Proc. Ent. Soc. Wash. 14, 1912, p. 219. Replies to Brues' criticism of one of his former papers.

KNAB, FREDERICK. Unconsidered factors in disease transmission by blood-sucking insects. Jour. Econ. Ent. Vol. 5, April, 1912, pp. 196–200. Points out that an insect must be more or less closely associated with man and habitually suck his blood if they are to be factors in the transmission of human blood diseases.

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M. NEVEU-LEMAIRE. Parasitology of domestic animals. Par des Animaux Domes.: Maladies Paras. non Bacter. Paris, 1912, pp. 1257. Vegetable and animal parasites of domestic animals; host lists and short bibliography.

NICOLL, W. Flies and other insects as carriers of infection. Brit. Med. Jour., 2, No. 2704, October 26, 1912.

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RUCKER, W. C. Insects and disease: the mechanical and biological methods of transmission. Sci. Am. 107, July 13, 1912, pp. 34–35. Setting forth the dangers from the presence of certain insects.

SERGEOIS, E. The role of insects as carriers of disease. Abs. in Jour. Amer. Med. Assn. 58, (1912), No. 8, pp. 594–595. A study of the bedbug and its possible relation to disease. Ordinarily plays the part of carrier only, seldom a host. Such diseases as relapsing fever and kala-azar probably remain epidemic in certain places on account of the bedbugs.

SIMPSON, JAS. J. Entomological research in British West Africa. II Northern Nigeria. Bul. Ent. Res. Vol. 2, pt. 4, January, 1912, pp. 301–356. Includes records of blood-sucking insects and other arthropods. Native names for insect and diseases carried by them. Protozoal diseases in man and other animals; remedial measures.

SNYDER, C. Reservoirs of contagion. Harpers 125, November, 1912, pp. 832–838. Many different kinds of animals have been shown to act as reservoirs in which are stored germs that cause disease in the same or other animals.

TIDSWELL, F. A review of the present situation as regards infectious protozoa. Sec. Rep. Gov. Bur. Microbiol. N. S. Wales, September, 1912, pp. 62–70. Important. List of parasites—hosts and carriers.

WILLIAMS, H. A. Messengers of death. Cosmop. 53, 724–735, November, 1912. Popular notes on several insects that carry disease.

Insects. The common forms in relation to public health and methods for their destruction. Pa. Health Bull. No. 32.

Insects as carriers of infectious diseases. Jour. Amer. Med. Assn. Vol. 59, No. 20, November 16, 1912, p. 1798. Editorial pointing out the importance of the recent discoveries.

Two pictures—a contrast. Comment Jour. Amer. Med. Assn. Vol. 59, July 6, 1912, p. 43. January 1 to June 1, 1912, Guayaquil had 147 cases yellow fever, 124 cases of bubonic plague. This is the "Pest hole of the Pacific." No cases of yellow fever or plague and but comparatively little sickness in Panama Canal Zone during the same period; used to be as bad as Guayaquil.

JOURNAL OF ECONOMIC ENTOMOLOGY

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The editors will thankfully receive news items and other matter likely to be of interest to subscribers. Papers will be published, so far as possible, in the order of reception. All extended contributions, at least, should be in the hands of the editor the first of the month preceding publication. Contributors are requested to supply electrotypes for the larger illustrations so far as possible. The receipt of all papers will be acknowledged.—Eds.

The Entomological Society of Ontario will be celebrating its semicentennial about as this number appears. The half century has been a period of progress and much of accomplishment must be credited to the residents north of a line political—not racial, social or faunal. Their problems are our problems. The long series of reports of this society and the numerous volumes of Canadian Entomologist contain a host of records concerning American insects, data of great value to all students of entomology. The organization may rightfully claim the honor of founding and supporting the oldest regularly issued entomological serial in the New World. This achievement alone is worthy of high praise. We are quite certain that all active entomologists, both economic and systematic, would gladly join in the felicities of the occasion and congratulate most heartily our Canadian friends on the record of the past and the even more brilliant prospects of the future.

There was a time when an entomologist was regarded as a man of limited outlook or at least a trifle narrow and inconsequential. Now certain entomological specialists appear to look upon the general student of insect life as a somewhat trifling jack-of-all-trades who accomplishes little of real value. There is more or less truth in both of these attitudes. American entomologists of the practical persuasion are mostly specialists and perhaps never happier than when learning new life histories or ascertaining hitherto undreamed of biological relationships. Such investigations, limited as they are to individual insects or more or less natural groups add, and add greatly to the sum of human knowledge and do much to increase the honor accorded the profession both in this country and abroad. There is such a thing as getting too close to a problem. It is possible to spend all our energy fighting an insect or studying individual pests so that no time or strength can be given to the broader prophylactic measures. International quarantine is excellent as a preventive though of little service after a pest has become well established. Why is one insect

a pest and a close ally insignificant? What are the determining factors in the case of either chronic or periodically injurious species? May any of these factors be modified to the practical advantage of man? Some men are giving more or less time to such problems, though usually in an incidental way and generally in relation to individual pests. Are not some of these broader questions worthy of the same concentration so frequently given problems of pressing practical importance?

Current Notes

Conducted by the Associate Editor

Sir John Lubbock (Lord Avebury) died May 28, aged 79 years.

A new four brood law has been enacted in Connecticut, becoming operative August 1.

Columbia University recently conferred the honorary degree of Doctor of Science upon Wm. C. Gorgas.

Professor George H. Parker was elected a member of the National Academy of Sciences at Washington, April 22–24.

Dr. C. Gordon Hewitt, Dominion Entomologist of Canada, was recently elected a Fellow of the Royal Society of Canada.

Professor T. D. A. Cockerell has received the honorary degree of Doctor of Science from Colorado College.

Mr. William Harper Dean, assistant and instructor in Entomology at the Texas College and Station, resigned April 1.

Professor S. W. Williston received the honorary degree of Doctor of Science from Yale University, June 18.

Mr. A. J. Mutchler has been appointed assistant in the department of invertebrate zoölogy at the American Museum of Natural History, New York City.

At the ecological conference at the University of Chicago this summer, Professors S. A. Forbes and Wm. M. Wheeler are to give illustrated lectures.

Dr. E. P. Sansten, recently appointed horticulturist of the College and Station at Auburn, Alabama, has resigned to accept a similar position at the Colorado State College.

W. E. Dove, a recent graduate of the Mississippi Agricultural College is now employed by the United States Bureau of Entomology and is located at Dallas, Texas.

Dr. M. W. Blackman, of the zoölogical department of Syracuse University, has been made associate professor of entomology in the New York State College of Forestry, Syracuse University.

Mr. W. F. Fiske, who has been connected with the gypsy moth parasite laboratory for several years, has resigned from the Bureau of Entomology and is spending the summer in Europe.

Assistant Surgeon General Wm. C. Gorgas, Professors J. H. Comstock and C. E. McClung, were elected members of the American Philosophical Society at Philadelphia, on April 19.

Mr. Benjamin W. Douglas, formerly state entomologist of Indiana, has started in business as a landscape gardener in Indianapolis, and will take charge of the planting of several large estates.

Charles H. Gable, entomologist and horticulturist for an Ottawa Kansas nursery, has been appointed by the government of Portugal to go to the Maderia Islands, to supervise work on the large fruit farms.

Mr. U. C. Loftin, formerly laboratory assistant in entomology at the Agricultural Experiment Station at Gainesville, Fla., is now an assistant in the Bureau of Entomology, and is stationed at Audubon Park, New Orleans, La.

Three of the recent graduates of the Mississippi Agricultural College, N. D. Guerry, J. C. Treloar, and H. O. French, are temporarily employed by the Bureau of Entomology and are now located at Tellulah, La., and are engaged in boll-weevil work.

The following changes have taken place recently in the Federal Horticultural Board: A. V. Stubenrauch succeeds Peter Bisset, and Dr. W. D. Hunter succeeds A. F. Burgess. Mr. Burgess resides in Melrose, Mass., and it was inconvenient for him to attend the meetings of the Board.

Professors Herbert Osborn, Ohio State University, Alexander D. MacGillivray, University of Illinois and Mr. Charles P. Alexander, Cornell University, will spend their summer vacations at the Agricultural Experiment Station at Orono, Me., and each will study the insects of the special group in which he is an authority.

According to *Science*, Mr. G. N. Wolcott, who is the traveling entomologist supported by the Porto Rico Sugar Growers' Association, is collecting parasites of the white grub to introduce into Porto Rico, where the white grubs are a very serious pest in the cane fields. Mr. Wolcott has his chief headquarters in the United States at the University of Illinois.

Professor A. L. Melander, Entomologist of Washington State College and Experiment Station at Pullman, has been granted a year's leave of absence for purposes of study. During the summer he will be at the Biological Laboratory at Cold Spring Harbor, and during the next college year will study under Dr. W. M. Wheeler at the Bussey Institution of Harvard University, Forest Hills, Mass.

According to *Science*, at the twenty-fifth reunion of the class of 1888 of Washington and Jefferson college, on June 17, a library memorial fund was established in honor of Dr. Jesse W. Lazear, U. S. A., a member of the class, who left before graduation to study medicine and who afterward became a member of the commission to investigate the rôle of the mosquito in the transmission of yellow fever, and sacrificed his life to the cause of scientific research.

A new organization is the Audubon Entomological Club, the first meeting of which was held at the office of the Bureau of Entomology at Audubon Park, New Orleans, La., on May 27, 1913. The general purpose of the Club will be the discussion of entomological subjects, especially in connection with the work of the various members. The Club will be entirely informal, and will have neither a constitution nor officers. The members, most of whom are connected with the Bureau of Entomology, are the following: Messrs. E. R. Barber, J. R. Horton, W. V. King, T. E. Holloway and Dr. Wm. E. Cross.

A hearing was held before the Federal Horticultural Board, at Washington, D. C., June 12, at 10 o'clock A. M. The question of extending the present quarantine lines in the New England States, on account of the spread of the gypsy and brown-tail moths, was considered.

In addition to the members of the Board the following entomologists were present: W. C. O'Kane, Durham, N. H.; A. F. Burgess, D. M. Rogers and L. H. Worthley, Boston, Mass.; W. E. Britton, New Haven, Conn.; E. D. Sanderson, Morgantown, W. Va., Congressman Roberts of Massachusetts, and a number of Christmas tree shippers were present.

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